Original Article

Alterations in Liver Function Test Following Laparoscopic Cholecystectomy

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Abstract

Introduction: CO2 pneumoperitoneum induced increased intra-abdominal pressure during laparoscopic procedures produces transient reduction in hepatic blood flow liver enzyme elevation. **Aims and Objectives:** The aim of this study is to study the alteration of liver function test (LFT) parameters such as aspartate aminotransferase/serum glutamic-oxaloacetic transaminase (SGOT), alanine-aminotransferase/serum glutamic-pyruvic transaminase (SGPT), alkaline phosphatase (ALP) and serum bilirubin (total and direct) in patients undergoing laparoscopic cholecystectomy. **Materials and Methods:** A prospective, cross-sectional study was conducted. The sample size was 50. Data collected were analysed using the SSPS software version 17. **Results:** Three quarters were females. The mean age of the study population was 48.5 ± 13.1 years, males having higher mean age of 57.0 ± 8.5 years compared to 45.5 ± 13.2 years for females. The SGOT, SGPT, ALP and bilirubin levels were significantly increased on the next day of surgery. There was a significant positive correlation between SGOT and SGPT levels on day 1 to the increased duration of pneumoperitoneum with correlation coefficient of 0.859 and 0.449, respectively. SGOT and SGPT levels were increased significantly in 61–80 years age group. **Conclusion:** The duration of pneumoperitoneum had a great effect on the LFT changes after surgery. Age influenced changes in SGOT and SGPT levels.

Keywords: Laparoscopy, liver function test, pneumoperitoneum, serum glutamic-oxaloacetic transaminase, serum glutamic-pyruvic transaminase

Introduction

Laparoscopic cholecystectomy (LC) is the gold standard for symptomatic gallstones disease in today's era.[1] Pneumoperitoneum with CO2 causes increased intra-abdominal pressure (IAP) leads to significant impairment of hepatic perfusion[2,3] and elevation in liver enzymes.[4] This is a matter of concern to the clinician and warrants further investigation to determine the underlying pathology. This study aims to investigate the pattern of incidence and alteration of liver function test (LFT) parameters such as aspartate aminotransferase/serum glutamic-oxaloacetic transaminase (AST/SGOT), alanine-aminotransferase (ALT/SGPT), alkaline phosphatase (ALP) and serum bilirubin (total and direct) in patients undergoing of LC.

Materials and Methods

A prospective, cross-sectional study was conducted among patients undergoing LC in a tertiary hospital. The sample size was calculated as 50 with the prevalence taken as 14% and with 10% absolute error at 95% confidence interval. Universal sampling method was used. Data were collected for January − December 2018.All patients undergoing LC were included after obtaining written consent. The exclusion criteria included common bile duct pathology, conversion to open cholecystectomy, bleeding disorders and intra-operative complication-common bile duct injury. Data, collected as per pro forma included history, physical examination and investigations to exclude generalised debility. The levels of AST/SGOT (normal range <35

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UL-1), ALT/SGPT (normal range <40 UL-1), serum bilirubin (normal range <1 mg/dL), serum ALP (range 60–170 UL-1), was measured pre-operatively (pre-op) once and then post-operatively (post-op) on Day 1, Day 3 (only in those patients who have an elevated LFT on POD1). Duration of the pneumoperitoneum, IAP used and the CO2 insufflation time were recorded in each procedure. All patients were catheterised before the surgery and anaesthesia involved was recorded. All received similar anaesthesia protocol and similar set of analgesic medications pre-op and post-op. Descriptive analysis was done to describe the study group. Paired *t*-test was used to look for significant alteration in the liver enzyme parameter values pre-op and post-op relation between pre-op and post-op LFT levels with age were correlated. The study was initiated after the approval from the Institutional Ethics Committee.

Results

Baseline characteristics: Majority of the patients included in the study (37%–74%) were females, with nearly three quarters being females (37 nos.). The mean age of the study population was 48.5 ± 13.1 years, males having higher mean age of 57.0 ± 8.5 years as compared to females with 45.5 ± 13.2 years. The age and gender wise distribution showed males were higher in age groups 41–50 years (61.5%), females were the highest in the age group 31–40 and 41–50 years (29.7% each) as detailed in Table 1.

Procedure details

All patients in the study underwent LC under general anaesthesia and were maintained on 14 mm of Hg IAP. Mean duration of pneumoperitoneum was 2.18 ± 0.3 h.

Liver function tests

Total serum bilirubin levels

The average pre-operation levels of total bilirubin in the patients were 0.806 mg/dl, which increased to 1.072 on day 1 post-op and slightly reduced to 0.910 on day 3. The total serum bilirubin levels were deranged in 1 patient in the pre-op setting and deranged in 11 patients on post-op day1 and 3 patients in post-op day 3.

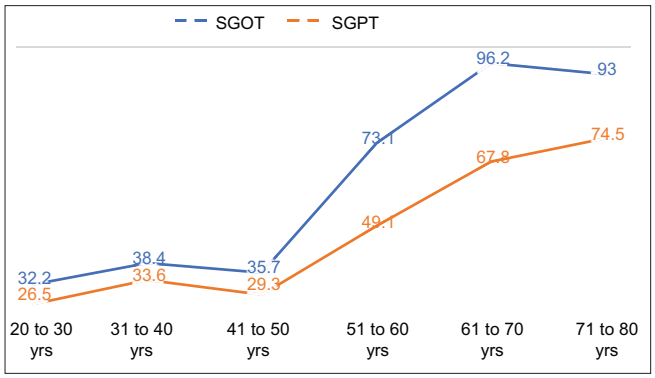

Figure 1: Serum glutamic-oxaloacetic transaminase, serum glutamic-pyruvic transaminase and age correlation

Direct serum bilirubin levels

The average pre-operation levels of direct bilirubin in the patients were 0.132 mg/dl, which increased to 0.294 on day 1 post-op and slightly reduced to 0.230 on day 3. The direct serum bilirubin levels were deranged in two patients in the pre-op setting and deranged in 20 patients on post-op day1 and 13 patients in post-op day 3.

Serum glutamic-oxaloacetic transaminase levels

The average pre-operation levels of SGOT in the patients were 26.68, which increased to 58.2 on day 1 post-op, and reduced to 32.38 on day 3. The SGOT levels were deranged in five patients in the pre-op setting and deranged in 36 patients on post-op day1 and 18 patients in post-op day 3 [Table 2].

Serum glutamic-pyruvic transaminase levels

The average pre-operation levels of SGPT in the patients were 29.48, which increased to 43.6 on day 1 post-op and reduced to 33.68 on day 3. The SGPT levels were deranged in 6 patients in the pre-op setting and deranged in 19 patients on post-op day1 and 20 patients in post-op day 3.

Alkaline phosphatase levels

The average pre operation levels of ALP in the patients were 96.74, which increased to 112.08 on day 1 post op and reduced to 104.36 on day 3. The total serum bilirubin levels were deranged in six patients in the pre op setting and deranged in 19 patients on post op day1 and 10 patients in post op day 3.

Table 1: Age and gender distribution

Age groups (years)	Total, *n* (%)	Male, *n* (%)	Female, *n* (%)
20-30	4 (8.0)	0	4 (10.8)
31-40	12 (24.0)	1 (7.7)	11 (29.7)
41-50	11 (22.0)	8 (61.5)	11 (29.7)
51-60	12 (24.0)	4 (30.8)	4 (10.8)
61-70	9 (18.0)	0	5 (13.5)
71-80	2 (4.0)	0	2 (5.4)
Total	50 (100)	13 (100)	37 (100)

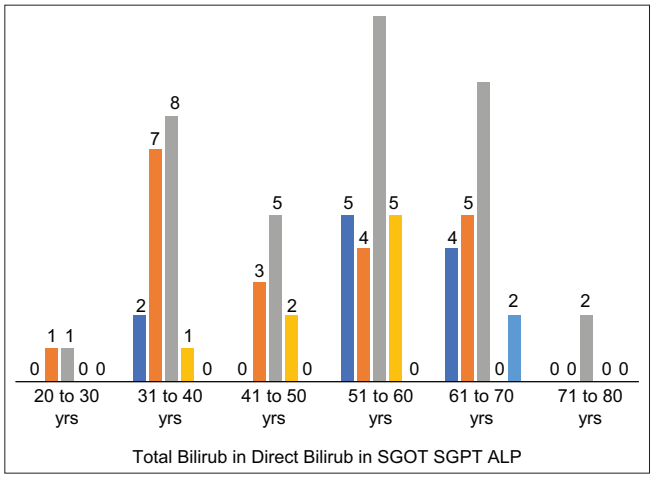

Figure 2: Liver function test and age with number of deranged patients

Table 2: Liver function test levels and age group

Liver enzymes on day 1	Age groups (years)					
	20-30	31-40	41-50	51-60	61-70	71-80
Total bilirubin	0.925±0.05	1.058±0.20	0.918±0.14	1.309±0.66	1.10±0.26	0.75±0.21
Direct bilirubin	0.250±0.12	0.350±0.15	0.282±0.12	0.267±0.18	0.33±0.19	0.100±0.0
SGOT	32.2±12.8	38.42±11.6	35.73±11.0	73.1±24.0	96.2±14.8	93.0±7.0
SGPT	26.5±2.1	33.58±11.2	29.3±9.4	49.1±28.5	67.8±16.4	74.5±3.5
ALP	100±24.0	107.7±31.6	127.5±24.3	102.2±24.8	122.7±38	89.0±42.4
LFT levels and age group on number of people with deranged values						
Liver enzymes on day 1	**Age groups (years)**					
	20-30	**31-40**	**41-50**	**51-60**	**61-70**	**71-80**
Total bilirubin	0	2	0	5	4	0
Direct bilirubin	1	7	3	4	5	0
SGOT	1	8	5	11	9	2
SGPT	0	1	2	5	0	0
ALP	0	0	0	0	2	0

SGOT: Serum glutamic-oxaloacetic transaminase, SGPT: Serum glutamic-pyruvic transaminase, ALP: Alkaline phosphatase, LFT: Liver function test

Pneumoperitoneum duration

The mean duration of pneumoperitoneum was 131 min and most of the patients (62%) were in it for duration of 120 − 140 min. A small minority of four patients finished it in <120 and 15 were more than 140 min.

'Correlation of LFT with pneumoperitoneum duration' there was a significant positive correlation between SGOT and SGPT levels on day 1 to the increased duration of pneumoperitoneum. A correlation coefficient of 0.859 for SGOT means that for every unit increase of pneumoperitoneum duration there is 0.850 times increase in SGOT levels. Similarly, SGPT levels had a correlation of 0.449. Other investigations did not yield any significant correlation.

Liver function test levels on different age groups

SGOT and SGPT levels were generally increased in higher age groups. The highest levels of SGOT were seen 61–70 years age group and next highest levels in 71–80 years age group, and this increase in values were statistically significant. Similarly, SGPT levels as highest in 71–80 years age group which was statistically significant. Total bilirubin levels also increased with age but were not statistically significant. Direct bilirubin and ALP levels did not show any significant change with age [Figure 1 and 2].

Discussion

It has been shown that the duration and level of IAP are responsible for changes in hepatic function during LC. Ziessman HA.[5] reported a significant increase in post-operative liver enzymes (alanine aminotransferase, ALT; aspartate aminotransferase, AST) in up to 80% of patients undergoing LC.

All patients in our study underwent LC under general anaesthesia and were maintained on 14 mm of hg IAP. In a reviewed study, it was shown that by keeping the low range of pressure 8–10 mmHg for pneumoperitoneum has been shown to decrease the adverse physiological changes without affecting the outcome of surgery as in the present study, pressure was kept 12–14 mmHg.[6]

Liver function test

In our study, the average pre-operation levels of total bilirubin in the patients were 0.806 ± 0.2 mg/dl, which increased to 1.072 ± 0.4 on day 1 post-op and slightly reduced to 0.910 ± 0.3 on day 3. The total serum bilirubin levels were deranged in 1 patient in the pre-op setting and deranged in 11 patients on post-op day1 and 3 patients in post-op day 3. The average pre-operation levels of direct bilirubin in the patients were 0.132 ± 0.1 mg/dl, which increased to 0.294 ± 0.2 on day 1 post-op and slightly reduced to 0.230 ± 0.2 on day 3. The direct serum bilirubin levels were deranged in two patients in the pre-op setting and deranged in 20 patients on post-op day 1 and 13 patients in post-op day 3. The average pre-operation levels of SGOT in the patients were 26.68 ± 7.9, which increased to 58.2 ± 29.4 on day 1 post-op, and reduced to 32.38 ± 9.7 on day 3. The SGOT levels were deranged in five patients in the pre-op setting and deranged in 36 patients on post-op day1 and 18 patients in post-op day 3. The average pre-operation levels of SGPT in the patients were 29.48 ± 14.6, which increased to 43.6 ± 23.8 on day 1 post-op and reduced to 33.68 ± 14.6 on day 3. The SGPT levels were deranged in six patients in the pre-op setting and deranged in 19 patients on post-op day 1 and 20 patients in post-op day 3. The average pre-operation levels of ALP in the patients were 96.74 ± 21.9, which increased to 112.08 ± 30.4 on day 1 post-op and reduced to 104.36 ± 22.9 on day. The total serum bilirubin levels were deranged in six patients in the pre-op setting and deranged in 19 patients on post-op day1 and 10 patients in post-op day 3. The reviewed studies also showed similar changes in the LFT before and after the surgery. Tan *et al.*[7] found statistically significant increased levels of hepatic transaminases during the first 48 h

post-operation in patients undergoing LC and laparoscopic colonic resection compared to patients having open procedures. They concluded that laparoscopic surgery may not be optimal for patients with pre-existing liver impairment. CO2 pneumoperitoneum is the most common reason for elevation of hepatic transaminases after laparoscopic surgery. However, if preoperative liver function was very poor, laparoscopic surgery may not be the best choice for the treatment of the patients with certain abdominal diseases.[7] Omari and Bani-Hani[8] investigated the serum levels of eight parameters of liver function both before and 24 h after surgery in 142 consecutive patients who underwent LC, 23 patients who underwent OC and in 25 patients who underwent a conventional hernia repair. They found that 83% of the patients showed more than 100% increase in at least one parameter, 43% showed an increase in two or more parameters and 23% showed an increased in 3 or more parameters.[8] Another prospective study was done to investigate the effect of abdominal perfusion pressure on LFTs after LC with IAP of 12 mmHg. They reported that 37.5% showed more than 100% increase in at least one parameter of liver function. Subclinical hepatic dysfunction after LC could mostly be attributed to the negative effects of pneumoperitoneum on hepatic blood flow.[9] Ahmad noted that the mean value for postoperative ALP was less than the pre-operative value, which suggests very little or no change in the postoperative value of this enzyme. This finding was commonly observed in patients with preoperatively elevated LFTs. It is evident that the level of alteration is different for each enzyme and that most of the cases fall into the group that shows up to a 50% increase in the LFTs. This change can be labelled as mild elevation and is considered negligible by many. Increased bilirubin levels were seen in a fraction of patients; ALP was not found to increase to such a high level in study. Mild-to-moderate elevation in LFTs may not be associated with any deleterious effect and in the absence of clinical indications, routine postoperative or preoperative LFT is unnecessary.[10]

Duration of pneumoperitoneum

In our study, the mean duration of pneumoperitoneum was 131 min and most of the patients (62%) were for the duration of 120–140 min. A small minority of four patients finished it in <120 and 15 were more than 140 min. The mean pneumoperitoneum duration was higher in our study, considering Marakis *et al*. who reported the mean duration of surgery in LC was 55 min (range, 40–70 min). In LC group, we found that the patient with minimum duration of surgery (40 min) had less elevation in liver enzymes (serum bilirubin, AST and ALT) as compared to the patient with maximum duration (90 min) of surgery.[11] In study by Singal *et al*., the mean duration of surgery in LC group was 57.7 min, and in open group, the mean duration of surgery was 61.8 min.[12] In our study, the duration of more than three quarter of the patients was very high, which may explain the higher levels of LFT derangements. There was a significant positive correlation between SGOT and SGPT levels on day 1 and increased duration of pneumoperitoneum. A correlation coefficient of 0.859 for SGOT means that for every unit increase of pneumoperitoneum duration there is 0.850 times increase in SGOT levels. Similarly, SGPT levels had a correlation of 0.449. Other investigations did not yield any significant correlation. This relates to the studies reviewed.

Liver function test levels in different age groups

In our study, three quarters were females. The mean age of the study population was 48.5 ± 13.1 years, with males having higher mean age of 57.0 ± 8.5 years, compared to 45.5 ± 13.2 years for females. The males were higher in age groups 41–50 years and females were highest in the age group 31–40 and 41–50 years. SGOT and SGPT levels were generally increased in higher age groups. The highest levels of SGOT were seen 61–70 years age group and next highest levels in 71–80 years age group, and this increase in values were statistically significant. Similarly, SGPT levels as highest in 71–80 years age group which was statistically significant. Total bilirubin level also increased with age but was not statistically significant. Direct bilirubin and ALP levels were not showing any significant change with age. The reviewed studies showed age group has no difference in the LFT levels in the study done by Omari and Bani-Hani.[8] Tan *et al*.[7] showed that there was higher LFT levels in aged people than in younger age group.

Conclusion

Majority of the patients were females. The mean age of the study population was 48.5 ± 13.1 years; males were having higher mean age of 57.0 ± 8.5 years when compared to 45.5 ± 13.2 years for females. The SGOT, SGPT, ALP, and bilirubin levels were near normal on preoperation day. By the next day, all the LFT levels were significantly increased. There was a significant positive correlation between SGOT and SGPT levels on day 1 due to the increased duration of pneumoperitoneum. SGOT and SGPT levels were generally increased in higher age groups. Total bilirubin levels also increased with age but were not statistically significant. Direct bilirubin and ALP levels did not show any significant change with age.

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Conflicts of interest

There are no conflicts of interest.

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