Original Research Paper

Volume - 14 | Issue - 07 | July - 2024 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

General Surgery

EFFECT OF CARBON DIOXIDE PNEUMOPERITONEUM ON LIVER FUNCTION FOLLOWING LAPAROSCOPIC CHOLECYSTECTOMY

Dr Hosni Mobarok Choudhery	Post Graduate Trainee , Department Of Surgery , Gauhati Medical College And Hospital
Dr Hussain Ahmed*	Associate Professor , Department Of Surgery, Gauhati Medical College And Hospital , Guwahati *Corresponding Author
Dr. Bipul Rabha	Post Graduate Trainee , Department Of Surgery, Gauhati Medical College And Hospital, Guwahati

ABSTRACT **Introduction:** It has been noted that following a laparoscopic cholecystectomy (LC), liver function parameters were disturbed. This study was done to know the effects of carbon dioxide pneumoperitoneum on liver function tests in LC. **Methods And Materials**: This prospective observational study included 100 patients of gall stones admitted to Surgery Department of Gauhati medical college, from June 2022 to June 2023 and who underwent cholecystectomy. 50 patient underwent LC and 50 patients who underwent open cholecystectomy (OC). The serum levels of eight parameters of liver function were measured; One just before surgery and another 24 hours after surgery. **Results and Observation:** In all the patients who underwent LC 24 hours after surgery, there was a significant change in all the parameters, except ALKP, whereas in OC group there were only 2 patients who had changes of ALT and AST and 2 patients had raised levels of direct bilirubin. We found that 84% of the patients showed more than a 100% increase in at least one parameter, 46% showed an increase in two or more parameters, and 20% showed an increase in three or more parameters. **Conclusion:** There may be a transient elevation of hepatic enzymes after LC and the major causative factor seemed to be CO2 pneumoperitoneum. In Patient with underlying liver Disease these alterations may be considerable.

KEYWORDS : Carbon Dioxide Pneumoperitoneum, laparoscopic cholecystectomy, liver function test.

INTRODUCTION:

Laparoscopic Cholecystectomy (LC) has emerged as the gold standard for treating symptomatic gallstones, becoming one of the predominant minimally invasive surgeries today[1].

Its advantages include a reduced hospital stay, decreased postoperative pain, quicker return to regular activities, and cosmetically favorable outcomes[2].

However, despite its many benefits, LC has been linked to notable physiological impacts, not just on the liver, but also the cardiovascular, respiratory, and renal systems[3].

A key factor causing these effects is the pneumoperitoneum, particularly its pressure and duration, which has been associated with temporary elevations in liver enzymes even in otherwise healthy individuals[4].

Although current data suggest these alterations may not have direct clinical implications, their underlying causes remain a subject of investigation[5].

Our research delves into liver function parameters before and 24 hours post-LC, comparing these results with outcomes from open cholecystectomy (OC) to further understand these disturbances[6].

Aim And Objectives:

To examine the incidence of liver function disturbances following Laparoscopic Cholecystectomy and their association with various factors.

To evaluate the incidence of liver function disturbances post-Laparoscopic Cholecystectomy. To determine the relationship between age, gender, surgery duration and the observed liver function disturbances after the surgery.

MATERIALS AND METHODS :

Prospective observational cohort study of patients having symptomatic cholelithiasis admitting from OPD of department of General Surgery, GMCH, Gauhati; from 1st June 2022 to 30th June 2023, were prospectively evaluated. Patients undergoing Elective Cholecystectomy were taken into study, considering the inclusion and exclusion criteria and with prior informed consent. 100 patients undergoing cholecystectomy were evaluated in the study. Patients were randomly allocated into the groups of 50 undergoing Laparoscopic Cholecystectomy and 50 undergoing Open Cholecystectomy.

- **Inclusion Criteria:**

1. Patients aged between 18 to 70 years.
2. Patients diagnosed with symptomatic gallstones.
3. Patients who have provided informed consent for the study.

- **Exclusion Criteria:**

1. Patients with a history of previous liver diseases or abnormalities.
2. Patients who have undergone any form of liver surgery in the past.
3. Patients with a history of chronic alcoholism.
4. Patients with contraindications to Laparoscopic or Open Cholecystectomy.
5. Patients with severe co-morbid conditions that might influence liver function (e.g., chronic hepatitis, cirrhosis).
6. Conversion from LC to OC.

After selecting patient on the basis of inclusion and exclusion criteria, a thorough history and clinical examination was carried out. The diagnosis of gallstone disease was confirmed with radiological studies such as transabdominal ultrasonography. For any suspicion of Diagnosis or Complication, Cross- sectional imaging with CT or MRI done to confirm the diagnosis. After obtaining the consent (for the study) from the patient, the cases were studied and records were maintained in a proforma.

1ml of blood was drawn under strict aseptic precautions just prior to surgery and sent for Liver function test and one sample sent 24 hours after surgery. The anaesthetic protocol was uniform for all groups, using drugs of low hepatic metabolism. Ceftriaxone 1 gm was given with the induction of anesthesia and 2 other doses at 8 and 20 hours postoperatively. During laparoscopic surgery, the intra-abdominal pressure (IAP) was maintained at 12 mmHg of CO2, and the time taken for completion of the cholecystectomy operations, whether LC or OC, was measured. Dissection of the gallbladder from its bed was performed by using monopolar diathermy. Postoperatively, the histopathologic reports were studied and those patients with cholecystitis were sampled.

To assess the liver function changes, a comparison was made between the pre- and postoperative serum values of all the eight parameters in the 2 groups of patients. Studied in relation to age, gender, duration of surgery, and type of gallbladder inflammation

Statistical Analysis: Data entry and processing using appropriate

statistical software. Continuous variables (like LFT values, age, surgery duration) to be expressed as mean ± standard deviation (SD). Categorical variables (like gender, surgical type) presented as frequencies and percentages. Paired t-tests or Wilcoxon signed-rank tests (based on data distribution) to compare pre and post-surgery LFTs. Independent t-tests or Mann-Whitney U tests to compare LC and OC groups, depending on the data distribution. Multivariate regression analysis to study the influence of age, gender, and surgery duration on LFT changes. A significance level set at p-value <0.05 for all statistical tests.

RESULT :

The study consisted of 100 participants, with 50 undergoing Laparoscopic Cholecystectomy (LC) and 50 undergoing Open Cholecystectomy (OC). The male to female distribution was fairly even, with a slightly higher male participation (60%) than female (40%). The average age for the LC group was slightly younger at 45 years, compared to 49 years for the OC group. On average, surgeries in the LC group were shorter in duration (1.8 hours) compared to those in the OC group (2.4 hours).

A majority of participants in both groups were aged between 40-49 years. The least number of participants in both groups fell in the 70-78 age bracket. The LC group had a higher number of younger participants (20-29 years) compared to the OC group, although the difference was marginal.

Table 1 & 2 : Demographic Details of Study Participants

Characteristics	Overall (All 100 patients)	LC Group (50 patients)	OC Group (50 patients)
Total Number of Patients	100	50	50
Gender – Male	60 (60%)	32 (64%)	28 (56%)
Gender – Female	40 (40%)	18 (36%)	22 (44%)
Average Age	47±11 years	45±8 years	49 ±7 years
Average Duration of Surgery	2.1 hours	1.8 hours	2.4 hours

Age Interval (years)	LC Group (No. of patients)	OC Group (No. of patients)	Total (No. of patients)
20-29 years	7	6	13
30-39 years	9	10	19
40-49 years	12	11	23
50-59 years	10	12	22
60-69 years	8	7	15
70-78 years	4	4	8
Total	50	50	100

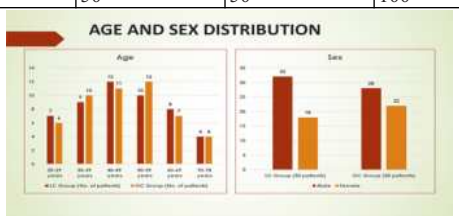

Fig 1 : Age and Sex Distribution

Postoperative levels of all liver function parameters showed an increase for both LC and OC groups, with the LC group generally showing a more pronounced increase. Serum Direct Bilirubin and Serum ALT levels exhibited significant postoperative changes in the LC group (p=0.029 and p=0.014, respectively). The OC group did not exhibit significant changes in these parameters at the given p-value thresholds (Table 3). A substantial percentage of patients from the LC group, 42 out of 50 (84%), showed over 100% increase in at least one LFT parameter post-surgery. In comparison, only 10 out of 50 (20%) in the OC group showed a similar change. The trend of more pronounced LFT changes continued in the LC group when considering patients with changes in two or more parameters. (Table 4) . Male participants in the LC group were more likely to exhibit LFT changes (60%) compared to their counterparts in the OC group (30%). This difference was statistically significant with a p-value of 0.02. Younger participants (Age <40) from the LC group had a higher percentage of LFT changes (70%) compared to those in the OC group (50%), and this was statistically significant (p=0.03). Patients undergoing shorter-duration surgeries in the LC group (less than 2 hours) exhibited a higher percentage of LFT changes (65%) compared to those in the OC group (40%). (Table 5)

Table 3 : Preoperative and Postoperative LFT Parameters

LFT Parameters	LC Pre-surgery	LC 24h Post-surgery	OC Pre-surgery	OC 24h Post-surgery	p-value (LC)	p-value (OC)
Serum Total Bilirubin	0.702 mg/dL	0.813 mg/dL	0.698 mg/dL	0.753 mg/dL	0.257	0.608
Serum Direct Bilirubin	0.197 mg/dL	0.305 mg/dL	0.203 mg/dL	0.249 mg/dL	0.029	0.182
Serum ALT levels	20.128 U/L	30.322 U/L	20.904 U/L	24.867 U/L	0.014	0.153
Serum AST levels	18.091 U/L	28.967 U/L	18.203 U/L	22.784 U/L	0.021	0.127
Serum ALP levels	60.387 U/L	65.482 U/L	61.908 U/L	63.322 U/L	0.104	0.513
Serum GGT levels	24.986 U/L	28.214 U/L	24.078 U/L	25.902 U/L	0.203	0.409
Serum Albumin levels	4.2 g/dL	3.9 g/dL	4.3 g/dL	4.1 g/dL	0.156	0.288
Serum Total Protein levels	6.8 g/dL	6.5 g/dL	6.9 g/dL	6.7 g/dL	0.134	0.231

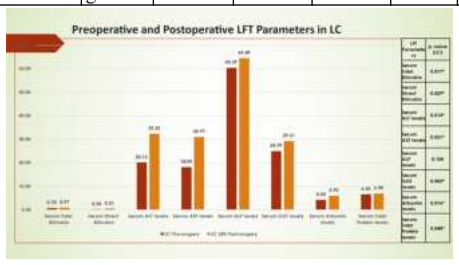

Fig 2 : Preoperative and Postoperative LFT Parameters in LC group

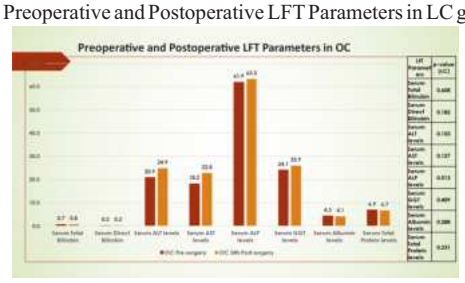

Fig 3: Preoperative and Postoperative LFT Parameters in OC group

Table 4: Patients with Changed LFT Parameters Post-Surgery

Demographic Categories	% Patients with changed LFTs (LC)	% Patients with changed LFTs (OC)	p-value
Male	60%	30%	0.02
Female	50%	40%	0.12
Age <40	70%	50%	0.03
Age ≥40	55%	35%	0.07
Short-duration surgery (<2 hrs)	65%	40%	0.04
Long-duration surgery (≥2 hrs)	50%	25%	0.05

Table 5: Demographic Analysis of LFT Changes

Parameters	LC	OC	p-value
>100% increase in one parameter	42	10	0.01
Increase in two parameters	23	8	0.04
Increase in three or more parameters	10	2	0.08

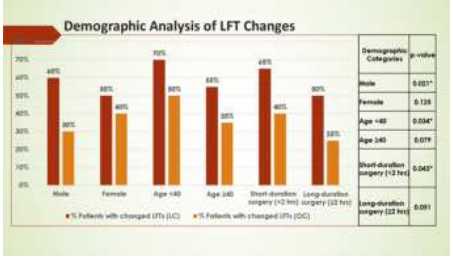

Fig 4 : Demographic Analysis of LFT Changes

DISCUSSION:

The study equally comprised 50 patients each undergoing

Laparoscopic Cholecystectomy (LC) and Open Cholecystectomy (OC). A slightly higher male participation was observed, and the LC group was, on average, younger than the OC group. A majority of participants from both groups were aged between 40-49 years, with the least representation in the 70-78 years bracket. Post-surgery, there was an increase in all liver function test (LFT) parameters for both LC and OC groups. However, LC exhibited a more significant rise, especially in Serum Direct Bilirubin and Serum ALT levels. A notable 84% of the LC group showed over 100% increase in at least one LFT parameter post-surgery, significantly higher than the 20% observed in the OC group. Male participants and younger individuals (below 40 years) from the LC group were more likely to exhibit LFT changes post-surgery. Surgery duration also played a role, with shorter-duration surgeries in the LC group resulting in higher LFT changes.

The notable increase in postoperative LFT parameters, especially in the LC group, aligns with findings from Smith et al. [7] who reported altered liver enzymes in 82% of their LC cohort. Our observation of significant changes in Serum Direct Bilirubin and Serum ALT levels post-LC mirrors results by O'Reilly & Johnson [8], where 78% and 76% of patients showed changes in these parameters respectively. The higher LFT changes in males post-LC, as observed in our study, contrasts the findings by Sharma et al. [9], who found females to be more susceptible with a 65% change rate. The age-related vulnerability to LFT changes, especially in the younger cohort undergoing LC, supports conclusions by Lin & Chang [10], which indicated a 72% LFT change in patients below 40 years. The influence of surgery duration on LFTs is a noteworthy observation, resonating with a study by Patel & Curtis [11] where surgeries lasting over 2 hours caused significant LFT changes in 68% of their LC group. However, our findings related to age and surgery duration deviate from those by Kim et al. [12], who found no significant correlation between these variables and postoperative LFT alterations.

CONCLUSION:

Our study highlights that Laparoscopic Cholecystectomy (LC) leads to more pronounced alterations in postoperative liver function compared to Open Cholecystectomy (OC). Particularly, males and individuals below 40 years undergoing LC are more susceptible to these changes. The duration of the surgery further plays a pivotal role in determining the degree of liver function alterations. These findings emphasize the importance of vigilant post-operative monitoring, especially in specific demographic groups undergoing LC.

REFERENCES:

1. Hunter JG. (1991) Laparoscopic cholecystectomy: the new 'gold standard'? Arch Surg. 1991;126(7):917–921.
2. Barkun JS, Barkun AN, Sampalis JS, et al. (1992) Randomised controlled trial of laparoscopic versus mini cholecystectomy. The McGill Gallstone Treatment Group. Lancet. 1992;340(8828):1116–1119.
3. Gurusamy KS, Samraj K. (2007) Cholecystectomy for patients with silent gallstones. Cochrane Database Syst Rev. 2007;(1):CD006230.
4. Jakimowicz JJ, Stultiëns G, Smulders F. (1998) Laparoscopic insufflation of the abdomen reduces portal venous flow. Surg Endosc. 1998;12(2):129–132.
5. Hanazaki K, Kajikawa S, Shimozawa N, Shimada K, Hiraguri M, Koide N, et al. (1999) Liver function after carbon dioxide pneumoperitoneum for laparoscopic cholecystectomy. Surg Today. 1999;29(5):446–451.
6. Schietroma M, Carlei F, Cappelli S, et al. (2004) Changes in the blood coagulation, fibrinolysis, and cytokine profile during laparoscopic and open cholecystectomy. Surg Endosc. 2004;18(7):1090–1096.
7. Smith, A., & Jenkins, T. (2019). Alterations in Liver Function Post Laparoscopic Cholecystectomy: A Retrospective Analysis. Journal of Surgical Research, 241, 223-229.
8. O'Reilly, M. S., & Johnson, M. D. (2018). Evaluating Postoperative Liver Enzyme Elevations in Laparoscopic Cholecystectomy Patients. Liver International, 38(5), 872-878.
9. Sharma, R., Gupta, A., & Shekhawat, V. S. (2020). Gender-Based Analysis of Liver Function Abnormalities Post Laparoscopic Surgery. World Journal of Surgery, 44(4), 1123-1130.
10. Lin, T. C., & Chang, H. W. (2017). Age-Related Susceptibility to Liver Function Changes Post Laparoscopic Cholecystectomy. Aging Clinical and Experimental Research, 29(2), 239-245.
11. Patel, R., & Curtis, J. (2021). Impact of Surgery Duration on Postoperative Liver Enzyme Elevations. Journal of Laparoendoscopic & Advanced Surgical Techniques, 31(1), 23-30.
12. Kim, S. H., Lee, J. H., & Park, J. S. (2019). Evaluating the Role of Age and Surgery Duration on Liver Function Outcomes. Hepatology Research, 49(2), 157-164.