



General Surgery

EFFECTS OF PNEUMOPERITONEUM ON HEPATIC ENZYMES IN LAPAROSCOPIC CHOLECYSTECTOMY AND VENTRAL HERNIA REPAIR

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ABSTRACT **Background:** In the sphere of medicine, the new period has seen significant changes. With newer technology and access to advanced services provided by various fields of medicine, surgical skills have improved from an older mindset of bigger incision, better surgeries to a less tissue damaging, cosmetically acceptable small incision or laparoscopic surgeries that have better patient acceptability. Every procedure has advantages and disadvantages, and laparoscopic surgeries are no different. Laparoscopic surgery side effects on the patient's body are frequently disregarded. There are very few studies that support the link between laparoscopic surgery and an increase in liver enzyme levels. Hepatocellular dysfunction brought on by CO₂ pneumoperitoneum, diathermy-induced liver extrusion, injury to a branch of the hepatic artery, or general anesthesia⁵. The purpose of this study was to assess the changes in blood liver enzymes before and after Laparoscopic cholecystectomy and ventral hernia repair. **Objectives:** 1. To study the incidence of alterations in liver function following Laparoscopic Cholecystectomy and ventral hernia repair in the Indian population. 2. To study the significance of these alterations in patients and the safety of the procedures. **Materials and Methods:** The study will be conducted on 100 patients undergoing Laparoscopic cholecystectomy and ventral hernia repair under variable intraperitoneal pressure (12-14mmHg) at Mysore Medical College and Research institute. The study will be designed to evaluate the complications of Laparoscopic ventral hernia repair especially the changes in liver enzymes. The liver function tests will be further done 24 hrs later and in some patients liver function test will be repeated to monitor liver function. **Results:** In this study, a statistically significant rise in liver enzymes (SGOT, SGPT, ALP and S.Bilirubin) was observed after 24 hrs of surgery as compared to preoperative values (p<.001) and there was significant positive correlation between duration of procedure and Post- operative day 1 values of SGOT, SGPT and ALP. **Conclusion:** In laparoscopic cholecystectomy and ventral hernia repair procedure results in a brief elevation of serum bilirubin and liver enzymes due to fall in hepatportal blood flow caused by raised intraperitoneal pressure by co₂ insufflation. The duration of pneumoperitoneum is directly correlated with the elevation in liver enzymes, so duration of procedure should be reduced as much as possible.

KEYWORDS : Laparoscopy, Cholecystectomy, Ventral hernia repair, Hepatic enzymes, Pneumoperitoneum.

Introduction:

In the sphere of medicine, the new period has seen significant changes. With newer technology and access to advanced services provided by various fields of medicine, surgical skills have improved from an older mindset of bigger incision, better surgeries to a less tissue damaging, cosmetically acceptable small incision or laparoscopic surgeries that have better patient acceptability. Laparoscopic surgeries have transformed many general surgical operations from open procedures to minimally invasive procedures with better cosmeses and less tissue damage, resulting in better patient compliance.

Because there was a high risk of damaging the surrounding structures, many diseases in the past could not be treated surgically. However, in the present, situations like impalpable testes, gallbladder disease, Hirschsprung's disease, and many others can be treated easily using a laparoscopic approach without the same risks. Every procedure has advantages and disadvantages, and laparoscopic surgeries are no different. Laparoscopic surgery side effects on the patient's body are frequently disregarded.

The detrimental effects of laparoscopic surgery on liver function are well-known. Numerous studies conducted in the past few years have revealed unexplained alterations in liver enzyme levels after laparoscopic surgeries. When compared to their pre-procedure levels, many patients' blood liver enzymes increase noticeably^{2,3,4}.

There are very few studies that support the link between laparoscopic surgery and an increase in liver enzyme levels. Hepatocellular dysfunction brought on by CO₂ pneumoperitoneum, diathermy-induced liver extrusion, injury to a branch of the hepatic artery, or general anesthesia⁵. The purpose of this study was to assess the changes in blood liver enzymes before and after Laparoscopic cholecystectomy and ventral hernia repair.

Objectives:

To study the incidence of alterations in liver function following Laparoscopic Cholecystectomy and ventral hernia repair in the Indian population.

- To study the significance of these alterations in patients and the safety of the procedure

Methods:

The study will be conducted on 100 patients undergoing Laparoscopic cholecystectomy and ventral hernia repair under variable intraperitoneal pressure (12-14mmHg) at Mysore Medical College and Research institute. The study will be designed to evaluate the complications of Laparoscopic ventral hernia repair especially the changes in liver enzymes.

All patients undergoing Laparoscopic cholecystectomy and ventral hernia repair will be invited to participate in the study and written informed consent will be taken. All patients will undergo a standard clinical and laboratory evaluation that includes briefly information about age, sex, address and routine investigation including ultra sound abdomen, which are done pre operatively.

Pre-operative investigations include liver function tests (SGOT, SGPT, alkaline phosphatase, gamma glutamyl transferase, bilirubin (direct), and bilirubin (total)).

The subject satisfying inclusion and exclusion criteria will be enrolled in the study.

The liver function tests will be further done 24 hrs later and in some patients liver function test will be repeated to monitor liver function. Adverse events will be noted in all the patients. Finally the duration of hospital stay will be noted. The patients who develop intra-abdominal complications will be excluded from the study.

Type of study: Prospective study

Study Period: 18 months, from July 2021 – December 2022

Sample size - 100

Sampling Technique: Convenience sampling technique

Inclusion Criteria:

- Patients with symptomatic cholelithiasis and ventral hernia.

- Age – 20 to 80 years

Exclusion Criteria:

- Any patient with pre-operative abnormality in liver enzymes.
- Suspected chronic liver diseases, Conversion to open, Hematological Disorders, Incomplete data.

Statistical Analysis:

Data was entered into Microsoft Excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and Proportions. Continuous data was represented as mean and SD. Paired t test is the test of significance for paired data such as before and after surgery for quantitative data. ANOVA (Analysis of Variance) was the test of significance to identify the mean difference between more than two groups for quantitative data. Graphical representation of data: MS Excel and MS word was used to obtain various types of graphs such as bar diagram, Pie diagram and Scatter plots.

Results:

This prospective and observational study was carried out to determine the effect of co2 on liver function test was studied. Hundred patients fulfilling the inclusion criteria from Surgery department of Mysore medical college and research institute during the period of July 2021 to December 2022.

All cases were evaluated clinically, only essential investigations necessary for diagnosis and preoperative assessment were carried out before operations.

Descriptive Statistics

Table 1: Age and Sex distribution of patients with ventral hernia.

SEX	Frequency	Percent
MALE	38	38
FEMALE	62	62
Total	100	100.0

FIG 1: SEX DISTRIBUTION IN CHART

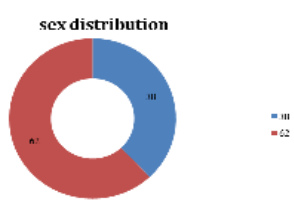


TABLE 2: PERCENTAGE OF AGE DISTRIBUTION

AGE GROUP	Frequency	Percent
26-35 YEARS	23	23.0
36-45 YEARS	45	45.0
46-60 YEARS	22	22.0
> 60 YEARS	10	10
Total	25	100.0

The mean age of patients was 42.5 with more than half of the patients (45%) belonging to the 36-45 age group.

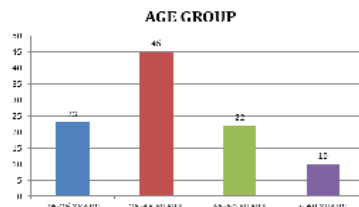


FIG 2: AGE distribution

TABLE 3: COMPARISON FOR TOTAL BILIRUBIN PRE-OP AND POST-OP

	Mean	SD	P value
S. Total Bilirubin pre-op (mg/dl)	0.61	0.32	
S. Total Bilirubin post-op 1 (mg/dl)	0.83	0.37	<0.001*

S. Total Bilirubin post op 3 (mg/dl)	0.63	0.26	0.41
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In our study pre-operative mean STB was 0.61 ± 0.32 mg/dl, which increased to 0.83 ± 0.37 mg/dl on 1st post-operative day and again reduced to 0.63 ± 0.26 mg/dl on 3rd post-operative day. There was significant increase in mean STB between Pre-operative and 1st Post-Operative day (P value <0.001).

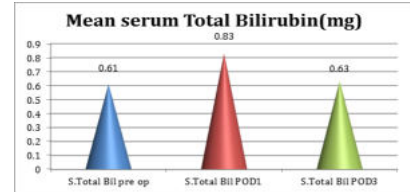


FIG 3 :COMPARISON FOR TOTAL BILIRUBIN PRE-OP AND POST-OP

Table 4: Comparison of Mean SGOT at Different Time Interval

	Mean	SD	P value
SGOT pre op (U/L)	32.24	15.75	
SGOT post op1 (U/L)	51.47	25.23	<0.001*
SGOT post op5 (U/L)	34.56	15.32	0.008*

In our study preoperative mean AST was 32.24 ± 15.75 U/L which increased to 51.47 ± 25.23 U/L on 1st post-operative day and again reduced near to pre-operative value of 34.56 ± 15.32 U/L on 5th post-operative day. There was significant increase in mean AST values between Pre-operative and 1st Post-operative day (P value <0.001).

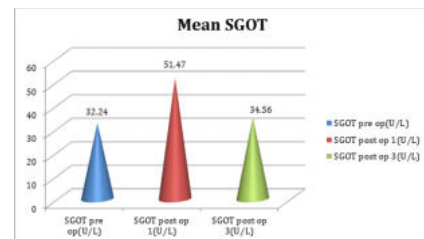


FIG 4 : Comparison of Mean SGOT at Different Time Interval

Table 5: Comparison of Mean SGPT at Different Time Interval

	Mean	SD	P value
SGPT pre op in U/L	30.6	14.6	
SGPT post op1 in U/L	58.3	27.5	<0.001*
SGPT post op3 in U/L	34.31	20.65	0.044*

In our study preoperative mean ALT was 30.6 ± 14.6 U/L which increased to 58.3 ± 27.5 U/L on 1st post-operative day and again reduced near to pre-operative value of 34.31 ± 20.65 U/L on 3rd post-operative day. There was significant increase in mean ALT values between Preoperative and 1st Post-Operative day (P value <0.001).

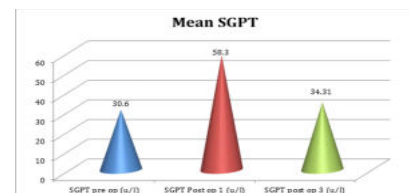
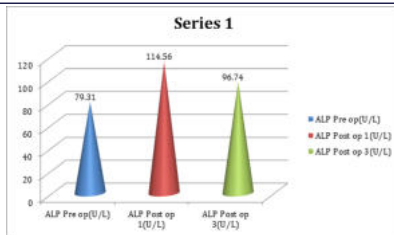


FIG 5 : Comparison of Mean ALP at Different Time Interval

Table 6: Comparison of Mean Serum Alkaline Phosphatase at Different Time interval

	Mean	SD	P value
ALP pre op in U/L	79.31	23.23	
ALP post op 1 in U/L	114.56	42.67	<0.001*
ALP post op 3 in U/L	96.74	36.13	0.481

In our study preoperative mean ALP was 79.31 ± 23.23 U/L which increased to 114.56 ± 42.67 U/L on 1st post-operative day and again reduced near to pre-operative value of 96.74 ± 36.13 U/L on 3rd post-operative day. There was significant increase in mean ALP values between Preoperative and 1st Post-Operative day (P value <0.001).



Graph 6: Comparison of Mean Serum Alkaline Phosphatase at Different Time Interval

Table 7: Correlation between Duration of Procedure and Liver enzymes at 1 day post operative period

		Duration of Procedure	S.Total bilirubin post op 1 (mg/dl)	SGOT post op 1 in U/L	SGPT post op 1 in U/L	ALP post op 1 in U/L
Duration of Procedure	Pearson Correlation	1	0.007	0.312**	0.290*	0.347**
	P value		0.892	<0.001*	0.021*	0.001*
	N	100	100	100	100	100

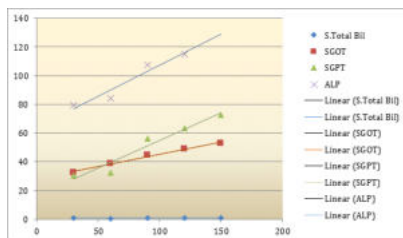


FIG 7: Correlation between Duration of Procedure and Liver enzymes at 1 day post operative period

Inference: In the study there was significant positive correlation between duration of procedure and Post-operative day 1 values of SGOT, SGPT and ALP i.e. with increase in duration of procedure, there was more increase in Postoperative day 1 SGPT, SGOT and ALP and vice versa. There was no significant correlation between Duration of procedure and mean STB on post-operative day 1.

Discussion:

Laparoscopic surgeries have become more popular recently because of newer technologies like endoscopic optics, video cameras, and endoscopic instrumentation. In addition to these and many other benefits, laparoscopic procedures have a small incision, less postoperative pain, less postoperative discomfort, a shorter hospital stay, and patients can return to their regular activities sooner.

In patients who have undergone laparoscopic operations, there are unexplained alterations in postoperative liver function seen in blood liver tests, which might be related to CO₂ pneumoperitoneum. The purpose of this study was to see if there was any clinical significance to the change in liver enzymes and serum bilirubin after laparoscopic surgeries.

The introduction of many litres of gas into the abdominal cavity causes a rise in intra-abdominal pressure. The cardiovascular alterations caused by pneumoperitoneum are determined by the interplay of several variables, including the patient's posture and the pace and volume of CO₂ insufflation.

IAP (>20 mm Hg) can cause increased vascular resistance, impacting the abdominal vasculature. A significant reduction in blood flow is observed, especially in the portal system, producing liver dysfunction with an elevation in IAP of >20 mmHg, which may continue postoperatively.

This result correlated with study done by Marakis et al.³ On alterations in liver function tests following Laparoscopic cholecystectomy, in which the mean STB was 0.64±0.24 mg/ml preoperatively and was 0.95±0.58 mg/ml 24 hours post-operatively there was increase of up to

48.4% which was statistically significant. Our result correlating this with study done by Hameed et al on impact of pneumoperitoneum on hepatic functions after laparoscopic surgeries showed that mean SGOT pre operatively was 31.23±5.51 U/L which increased to 53.79±12.92 U/L on 2nd postoperative day and returned to 31.20±5.75 U/L on 10th post-operative day.² There was statistically significant increase in the levels of mean serum SGOT post operatively. Changes in serum liver enzymes after laparoscopic procedures was the study done by Tan et al, showed that mean SGOT increased after laparoscopic cholecystectomy from 28.4±20.2 to 41.5±24.7 U/L on post op day 1 (p<0.05).

In this study correlates this with the study done by Hameed et al on impact of pneumoperitoneum on Hepatic functions after Laparoscopic surgeries showed that SGPT pre operatively was 28.19±5.29 U/L, 2nd day postoperatively was 51.11±13.06 U/L and on 10th post op day 29.16±5.40 U/L there was statistically significant results.

Changes in serum LFT's after laparoscopic surgery was the study done by Tan et al showed that mean value of SGPT increased after laparoscopic cholecystectomy from pre-operative value of 23.3±11.6 U/L to 38.8±15.2 U/L on post op day 1 (p<0.05) and it was 25.1±14.3 U/L on postoperative day 7.⁵

There was statistically significant increase in SGPT levels postoperatively in patients underwent laparoscopic surgeries but no significant changes preoperative and postoperative SGPT values in open cholecystectomy group.

Our results are Correlated with the study done by Rao et al on Alterations in liver function tests following laparoscopic surgery and showed that mean value of ALP in preoperative period was 101.03±21.279 U/L, its value was 135.517±31.472 U/L on post-operative day 1 and on postoperative day 3 it was 107.583±22.865 U/L, showing that mean values of ALT increased significantly (p<0.001) by post-operative day 1.⁹

In our study a positive correlation was noted between the duration of pneumoperitoneum and increased in liver enzymes level which is similar to other study conducted by Hameed et al, effect of pneumoperitoneum on hepatic functions after Laparoscopic surgeries.²

Regardless of the kind of laparoscopic technique, serum total bilirubin and serum liver enzymes (serum AST, ALT, and Alkaline phosphatase levels) were found to be considerably higher on the first post-operative day. Patients with a longer period of pneumoperitoneum had higher levels of liver enzymes. Serum bilirubin elevation does not correspond with longer pneumoperitoneum duration.^{3,5,9}

Conclusion:

In laparoscopic cholecystectomy and ventral hernia repair procedure results in a brief elevation of serum bilirubin and liver enzymes due to fall in hepatoportal blood flow caused by raised intraperitoneal pressure by CO₂ insufflation. However, in patients with normal hepatic function, these elevations are not clinically significant. The duration of pneumoperitoneum is directly correlated with the elevation in liver enzymes, whereas the duration of pneumoperitoneum is not correlated with the elevation in serum bilirubin.

As benefits of the procedure overcome its limitations, laparoscopic surgery is routinely done and Laparoscopic procedures should thus be maintained as brief as possible and should not be overly prolonged. Quick decision-making is required while switching from laparoscopic to open surgery in patients with liver disorders and in prolonged difficult procedures.

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