

## Effects of laparoscopy on liver enzymes.

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### Abstract

**Introduction:** Laparoscopic procedures have gained popularity in recent days because of advantages like small incision, less postoperative pain and discomfort, short hospital stay, early ambulation and early discharge. Very few studies are available to correlate Laparoscopic Surgeries and liver enzyme elevation. This effect may be due to either CO<sub>2</sub> pneumoperitoneum, diathermy extruding liver, injury to branch of the hepatic artery or general anesthesia. **Objective:** This study was done to evaluate the changes in liver enzymes pre-operatively and post-operatively following laparoscopy. **Methods:** This prospective study included 103 patients who underwent various laparoscopic surgeries over a period of 1 year in Alluri sita rama raju academy of medical sciences , eluru,India. Serum AST, ALT and bilirubin levels were measured preoperatively and on post-operative day 1 and post-operative day 3. Patients with coexisting liver disease, Patients on long term use of hepatotoxic drugs, patients who developed complications such as CBD injury, obstruction, infection, leakage and high grade fever during surgery and in the post-operative period were excluded. **Results:** All laparoscopic procedures cause a transient elevation of serum bilirubin and liver enzymes. Elevation in the liver enzymes correlated directly with the duration of pneumoperitoneum. Elevation in the serum bilirubin but doesn't correlates with the duration of pneumoperitoneum. These elevations do not have clinical significance in patients with normal hepatic function preoperatively.

**Conclusions:** Duration of laparoscopic procedure should be kept to minimum and undue prolongation should be avoided. Decision to convert the operation to open surgery from a laparoscopic surgery should be prompt.

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### I. Introduction :

The new era has seen several changes in the field of medicine. With newer technology and access to advanced services provided by different fields of medicine, the surgical skills have improved from older mind set of bigger incision, better surgeries to a less tissue damaging, cosmetically acceptable small incision or laparoscopic surgeries which have better patient acceptability.

Laparoscopic surgeries have changed many general surgical procedures from performing standard open procedures to minimally invasive procedures which have better cosmoeses, less tissue damage, thereby leading to better patient compliance

Many diseases in the past were not managed surgically due to high chances of damaging surrounding structures but the present day scenario is different as these situations are managed easily with laparoscopic approach, like impalpable testes, gallbladder disease, Hirschsprung's disease and many more such procedures

which have more complications if done via open surgical approach.

Any technique has its own pros and cons, which applies to laparoscopic surgeries also. The adverse effects of laparoscopic surgeries on patient's body are often neglected. The widely known adverse effect of laparoscopic surgeries is its effects on liver function. In the last few years, many studies have shown 'unexplained' changes in liver enzymes during postoperative period after laparoscopic procedure

The serum liver enzymes increase significantly in many patients who had a normal liver enzyme before the procedure. 2-4 Very few studies are available to justify the correlation between Laparoscopic Surgeries and liver enzyme elevation.

The cause for elevated liver enzymes has remained unknown so.

## II. Materials And Methods :

**Study design** :Prospective study

**Study settings** :Department of General SURGERY,  
Alluri Sita Rama Raju academy of medical sciences , Eluru.

**Study period** :one year

### STUDY METHODS :

This prospective study was done to evaluate the effect of laparoscopic surgeries on hepatic function. The patient population included in the study were selected by purposive sampling method from those who underwent laparoscopic surgeries in Alluri Sita Rama Raju academy of medical sciences , Eluru. The study was conducted from October 2020 to August 2021.

All the patients studied were selected using Purposive sampling method for laparoscopic surgeries after routine history taking, physical examination and investigations to exclude pre-existing liver diseases. Various laparoscopic procedures were performed on 103 patients and they constituted the study population.

Sample size was estimated by using the proportion of subjects with increased AST in laparoscopic subjects was 58.2% from the study by Singal R, Singal RP, Sandhu K, Singh B, Bhatia G, Khatri A studied on Evaluation and comparison of postoperative levels of serum bilirubin, serum transaminases and alkaline phosphatase in laparoscopic cholecystectomy versus open cholecystectomy.

All Patients undergoing laparoscopic procedures in the Department of General Surgery, ASRAMS , eluru were included in this study

All patients with coexisting liver disease, Patient on long term use of hepatotoxic drugs, Patients that develop complications such as CBD injury, obstruction, infection, leakage and high grade fever during surgery and in the post- operative period.

## III. Results :

In this study preoperative mean AST was 34.83±24.80 U/L which increased to 53.8±28.96 U/l on 1st postoperative day and again reduced near to pre- operative value of 37.06±22.08 U/l on 3rd post- operative day. There was significant increase in mean AST values between Pre-operative and 1st Post- operative day .

**Table 1:** Comparison of mean AST at different time interval.

	Mean	SD	P value
AST pre op in U/l	34.83	24.80	
AST postop1 in U/l	53.80	28.96	<0.001*

In this study preoperative mean ALT was 35.93±26.51 U/l which increased to 54.58±29.28 U/l on 1st postoperative day and again reduced near to pre- operative value of 37.06±22.08 U/l on 3rd post- operative day. There was significant increase in mean ALT values .

	Mean	SD	P value
ALT pre op in U/l	35.93	26.51	
ALT post op1 in U/l	54.58	29.28	<0.001*

In this study preoperative mean ALP was 98.42±51.64 U/l which increased to 122.96±46.67 U/l on 1st postoperative day. There was significant increase in mean ALP values between Pre-operative and 1st PostOperative day (p<0.001).

	Mean	SD	P value
ALP pre op in U/L	98.42	51.64	
ALP post op 1 in U/L	122.96	46.67	<0.001

	Mean	SD	P value
STB preop in mg/dl	0.62	0.31	
STB post op 1 in mg/dl	0.82	0.36	<0.001*

In this study the pre-operative mean serum total bilirubin (STB) was 0.62±0.31 mg/dl, which raised to 0.82±0.36 mg/dl on 1st post- operative day and again reduced to 0.63±0.27 mg/dl on 3rd post- operative day. There was significant increase in mean STB between pre-operative and 1st post-operative day .

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

	Duration of procedure	STB post op 1 in mg/dl	AST postop1 in U/l	ALT post op1 in U/l	ALP post op 1 in U/l
Pearson correlation	1	0.008	0.340	0.227	0.325
P value		0.939	<0.001	0.021*	0.001*
N	103	103	103	103	103

In the study there was no significant correlation between Inflation pressure and Post-operative values of STB, AST, ALT and ALP on day 1

	Inflation pressure	STB post op 1 in mg/dl	AST postop 1 in U/l	ALT post op1 in U/l	ALP post op 1 in U/l
Pearson correlation	1	-0.078	0.124	0.118	0.051
P value		0.436	0.210	0.235	0.607
N	103	103	103	103	103

#### IV. Discussion

Laparoscopic procedures have gained popularity in recent days because of newer technologies like endoscopic optics, video cameras and endoscopic instrumentation, to add on to this many other advantages are incision is small, less postoperative pain, less postoperative discomfort, hospital stay is shortened, patients are ambulated early and can return to their routine activities early.

Laparoscopic surgeries are also accompanied by unexplained significant physiological changes which are specifically unique to these procedures. There are unexplained changes in postoperative liver function reflected in serum liver enzymes in patients who have undergone laparoscopic procedures which is

hypothetically attributed to CO<sub>2</sub> pneumoperitoneum.

This study was undertaken to assess the change in liver enzymes and serum bilirubin after laparoscopic surgeries and if it has any clinical significance. In laparoscopy insufflation of gases through Veress needle at the rate of 1-2 L/min, pneumoperitoneum is initiated.

Overall pressure of the diaphragm at this point is about 50 kg in the Trendelenburg position at an IAP of 15mm Hg once pneumoperitoneum is achieved.

Increased IAP, temperature variations (hypothermia), CO<sub>2</sub> absorption, and neuro-hormonal stress response is produced as a result of pneumoperitoneum. The introduction of several liters of gas into the abdominal cavity results in an increased intra-abdominal pressure.

Cardiovascular changes associated with pneumoperitoneum depends on the interaction of factors including position of the patient, rate and amount of insufflation of CO<sub>2</sub>.

IAP (>20 mm Hg) can lead to prograde flow with increased vascular resistance thereby adversely affecting the abdominal vasculature. Marked decrease blood supply is seen mostly in portal system of about 60 per cent causing liver dysfunction with increase of IAP of >20mmHg and this might persist postoperatively.

## **V. Serum Total Bilirubin**

This result correlated with study done by Marakis et al.<sup>3</sup> On alterations in liver function tests following Laparoscopic cholecystectomy in which the mean STB was  $0.64 \pm 0.24$  mg/ml preoperatively and was  $0.95 \pm 0.58$  mg/ml 24 hours post-operatively there was increase of up to 48.4% which was statistically significant.

Nahvi et al measured liver enzymes preoperatively, 24 hours post-operatively and on 7th postoperative day. Their study population was divided into 2 groups. Group A patients underwent low pressure laparoscopic cholecystectomy (LPLC) that is pneumoperitoneum maintained at 8mm of Hg and group B patients were subjected to high pressure laparoscopic cholecystectomy (HPLC) in which pneumoperitoneum was maintained at 14 mm of Hg.

In HPLC group mean value of preoperative STB was  $0.75 \pm 0.10$  mg/dl, which increased to  $0.79 \pm 0.09$  mg/dl on post-operative day one and returned to near pre-operative values of  $0.73 \pm 0.08$  mg/dl on postoperative day 7. Whereas no significant change was noted in LPLC group.

### **SERUM AST**

Our result correlating this with study done by Hameed et al on impact of pneumoperitoneum on hepatic functions after laparoscopic cholecystectomy (LC) showed that mean AST pre operatively was  $31.23 \pm 5.51$  U/l which increased to  $53.79 \pm 12.92$  U/l on 2nd postoperative day and returned to  $31.20 \pm 5.75$  U/l on 10th post-operative day.

There was statistically significant increase in the levels of mean serum AST on 2nd post-operative day and by 10th post-operative day the values returned preoperative levels.

Changes in serum liver enzymes after laparoscopic procedures was the study done by Tan et al, showed that mean AST increased after laparoscopic cholecystectomy from  $28.4 \pm 20.2$  to  $41.5 \pm 24.7$  U/L on post op day 1 .

### **SERUM ALT**

In this study correlates this with the study done by Hameed et al on impact of pneumoperitoneum on Hepatic Functions after LC showed that ALT pre operatively was  $28.19 \pm 5.29$  U/l, 2nd day postoperatively was  $51.11 \pm 13.06$  U/l and on 10th post op day  $29.16 \pm 5.40$  U/l there was statistically significant increase in the levels of serum ALT was noted in samples of 2nd post-operative day and on 10th post op day the values returned preoperative levels.

Changes in serum LFT's after laparoscopic surgery was the study done by Tan et al showed that mean value of ALT increased after laparoscopic cholecystectomy from pre-operative value of  $23.3 \pm 11.6$  U/l to  $38.8 \pm 15.2$  U/l on post op day 1.

### **SERUM ALP**

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  $101.03 \pm 21.279$  U/l, its value was  $135.517 \pm 31.472$  U/L on post-operative day 1 and on postoperative day 3 it was  $107.583 \pm 22.865$  U/l,

showing that mean values of ALT increased significantly by post operative day 1 .

A study was done by Hameed et al on Impact of Pneumoperitoneum on Hepatic Functions after Laparoscopic Cholecystectomy showed that mean ALP pre-operatively was 204.46±43.67 U/l, on 2nd day postoperatively was 84.51±41.80 U/l and on 10th postoperative day it was 203.42±43.04 U/l which was not significant.

#### **DURATION OF PNEUMOPERITONEUM :**

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

#### **PNEUMOPERITONEUM PRESSURE :**

Intra-abdominal pressure in all the patients of our study was maintained between 12-14mmHg which was higher than normal portal venous pressure of 7-10mmHg. Thus, the elevation in Serum bilirubin and liver enzymes can be attributed to relative ischemia of liver, as major blood to liver is supplied by portal vein.

Pneumoperitoneum at 15 mmHg causes decrease blood flow to all abdominal organs, by 40-54% to stomach, by 44% to colon, by 39% to liver, by 32% to jejunum and by 60% to peritoneum .

Study conducted by Nahvi et al has evaluated the changes in the liver function tests and their clinical significance after uneventful laparoscopic cholecystectomy .

They have observed that laparoscopy cholecystectomy done at low pressure of 8 mm Hg does not produce elevation in liver enzymes. Study conducted by Giraud et al concluded that laparoscopic surgery without creating pneumoperitoneum does not produce much alterations in hepatic function.

Authors have found that serum total bilirubin and the serum liver enzymes (serum AST, ALT and Alkaline phosphatase levels) were found to be significantly elevated on 1st post-operative day irrespective of type of laparoscopic procedure. Patients with prolonged duration of pneumoperitoneum showed more elevation in the liver enzymes. Elevation of serum bilirubin does not correlate with prolonged duration of pneumoperitoneum.

On postoperative day 1 maximum raise was found in mean values of AST and ALT i.e., 34.91% and 34.65% respectively followed by serum total bilirubin which increased by 21.87% and least increase was noted in the mean values of ALP that increased by 19.85%.

No clinical significance was found to be associated with such elevation

### **VI. Conclusion**

From this study authors hereby conclude that, all laparoscopic procedures cause a transient elevation of serum bilirubin and liver enzymes, elevation in the liver enzymes correlated directly with the duration of pneumoperitoneum, elevation in the serum bilirubin but doesn't correlates with the duration of pneumoperitoneum, these elevation does not have clinical significance in patients with normal hepatic function. Thus, duration of laparoscopic procedure should be kept to minimum and undue prolongation should be avoided. Decision to convert the operation to open surgery from a laparoscopic surgery should be prompt.

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