



## Changes in serum bilirubin after laparoscopic cholecystectomy

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### Abstract

**Introduction:** *Marked changes has been evoked in modern era in approach to surgical diseases by laparoscopic procedures. All Laparoscopic procedures are usually performed by creating pneumoperitoneum. The main advantage of laparoscopic procedures is lesser tissue trauma due to smaller incision. Apart from advantages in laparoscopic procedures; effects of pneumoperitoneum on the cardiovascular and respiratory system resulting in several pathophysiological changes in the patients have been reported. 'Unexplained' changes noted in postoperative liver function tests (LFT) and serum bilirubin in patients undergoing laparoscopic procedures have been stated recently. These changes are transient and could occur after laparoscopic procedures. One of the reasons for the changes in LFT and serum bilirubin might be the CO<sub>2</sub> pneumoperitoneum. Hence, the study is performed to correlate the changes in serum bilirubin pre-operative and post operative period.*

**Materials and Methods:** *It is a descriptive study in which serum bilirubin of 31 patients who had underwent laparoscopic cholecystectomy using CO<sub>2</sub> to create pneumoperitoneum. Blood sampling were collected both preoperatively and post operatively on day 1 and day 3 for serum bilirubin along with routine investigations.*

**Results:** *There is significant rise in serum bilirubin on post op day 1 with p- value <0.0001. And eventual decrease of values to near pre operative on post op day 3.*

**Conclusion:** *In this study we conclude that there was a transient changes in serum Bilirubin on the POD-1 which reverted back to near normal to the pre-operative level by POD-3. There was no complication, no morbidity and no mortality.*

**Keywords:** *Laparoscopic procedures, serum bilirubin, CO<sub>2</sub> pneumoperitoneum.*

### Introduction

Over several decades, many individuals cultivated the access for laparoscopy. The scientific modernization implement a magnified picture of the operation field on to the monitor, facilitating performance of complex laparoscopic procedures, with least damage.<sup>1</sup>

Laparoscopy provides access to the peritoneal cavity for diagnosis and for many surgical interventions that were previously possible only by laparotomy.<sup>2</sup>

Pneumoperitoneum is important factor of laparoscopy. Insufflation with it helps to maximize the working space in a limited

contained cavity. During insufflation, the abdominal wall gets elevated and the viscera gets suppressed.<sup>3</sup>

Carbon dioxide (CO<sub>2</sub>) is the preferred gas for pneumoperitoneum. This method of creating pneumoperitoneum using CO<sub>2</sub> is referred to as capnoperitoneum.<sup>4</sup> The intraabdominal pressure of 12–14 mmHg of carbon dioxide (CO<sub>2</sub>) traditionally used in laparoscopic surgery is higher than normal pressure values of the portal system (7–10 mmHg).<sup>5</sup>

However, surgery laparoscopy also has its own limiting factors. It produces elevated intra-abdominal pressure (IAP) and continuous compression on intra-abdominal organs with elevation of diaphragm, which might potentially influence the hepatic, pulmonary and renal functions.<sup>4</sup>

Pneumoperitoneum created with CO<sub>2</sub> for laparoscopic cholecystectomy in head up position leads to greater risk of decrease in cardiac output and it may affect hepatic perfusion.<sup>5</sup>

### Materials and Method

This was descriptive study to assess changes in total and direct bilirubin in patients undergoing laparoscopic cholecystectomy. Studied in 31 patients who underwent laparoscopic cholecystectomy at department of general surgery Sri Siddhartha Medical college hospital and Research Centre, Tumkur, Karnataka for 24 months.

Institutional ethical committee (IEC) approval and written informed consent of patient was taken before the study started. Patients having altered liver enzymes preoperatively and <18yrs, pregnancy, lactation are excluded.

Detailed history and clinical examination of all patients was performed as per the study proforma. Preoperative LFT and post – operative LFT on day 1 and 3 along with other routine blood investigations (CBC, RFT, HBsAg, HCV, HIV) was collected.

Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency and proportion for categorical variables. Paired t- test was used for statistical analysis. P value <0.001 was considered statistically significant. IBM SPSS version 22 was used for statistical analysis.

Data was represented in tables and bar diagrams.

### Result

Out of 31 patients who underwent laparoscopic cholecystectomy 7 were male and 24 were female which was shown Table 1. The mean duration of pneumoperitoneum during the procedure was 41.2±37.4 min and the mean carbon dioxide pressure maintained was 12.9 ±1.72 mm Hg. Intra-op liver injury was observed in all patients during liver bed dissection.

Table 2. compares the pre-operative mean values of serum bilirubin and direct bilirubin with post operative mean values of serum bilirubin and direct bilirubin are increased significantly with p<0.001.

And table 3. Shows mean values of serum bilirubin and direct bilirubin on post- operative day 3, which have come down to near preoperative values with p value 0.373 and 0.557 respectively.

In table 4. There is no significant relationship of serum bilirubin and direct bilirubin with duration of procedure.

In relation to carbon pneumoperitoneum pressure, there is statistical rise in mean values of serum bilirubin and direct bilirubin as shown table 5.

**Table 1:** Descriptive analysis of gender in study population (N=31)

Gender	Frequency	Percentage
Male	7	22.58%
Female	24	77.42%

**Table 2:** Changes on post-op day 1

Parameters	Pre-op	Post-op Day 1	p-value
Serum bilirubin	0.56±0.26	0.83±0.35	<0.001
Direct bilirubin	0.16±0.08	0.24±0.11	<0.001

**Table 3:** Changes on post-op day 3

Pparameters	Pre-op	Post-op Day 3	p-value
Serum bilirubin	0.56±0.26	0.58±0.26	0.373
Direct bilirubin	0.16±0.08	0.16±0.07	0.557

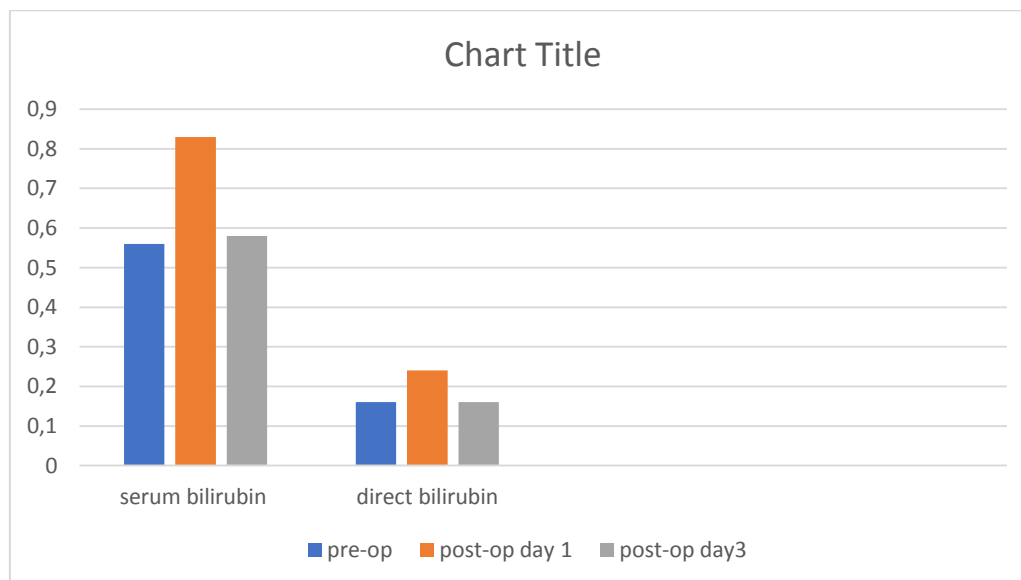
**Table 4:** Relationship between duration of procedure & elevation in liver enzymes

Liver enzymes	<60min	>60min	T	P-value
Serum bilirubin	0.24	0.34	-1.545	0.128
Direct bilirubin	0.07	0.09	-0.881	0.382

**Table 5:** Relationship between insufflation pressure & elevation in liver enzymes

Liver enzymes	Upto 14mmHg	>14mm Hg	T	P-value
Serum bilirubin	0.22	0.39	-2.571	0.013
Direct bilirubin	0.58	0.12	-2.784	0.007

**Graph 1:** Graph showing bilirubin changes in laparoscopic procedure on pre-op, post-op day 1 and post-op day 3



**Discussion**

One of the established method of treatment for many surgical conditions is laparoscopic surgeries.

Due to the technological advances in endoscopic optics, video cameras and endoscopic instrumentation the laparoscopic procedures had progressed widely<sup>6</sup>.

Some of the advantages of laparoscopic procedures like smaller incisions, reduced postoperative pain, shorter hospital stay, early ambulation and return to work had increased its popularity<sup>6</sup>.

Many studies disclosed unexplained changes in total and direct bilirubin in patients undergoing

laparoscopic procedures due to CO2 pneumoperitoneum created during procedures.<sup>6</sup>

According Brundell et al., duration of CDP had no effect on hepatic blood flow<sup>7</sup>.

In our setting there are no studies to evaluate the effects of laparoscopic surgery on direct and total bilirubin.

In this study the effect of pressure and duration of intra-operative CDP on total and direct bilirubin in laparoscopic procedure was assessed.

The post-operative increase seen in the levels of serum bilirubin was transient and returned to near pre operative levels within 3days of surgery.

The Mean Difference of Total bilirubin and direct bilirubin are statistically significant when

Preoperative and Post-operative Day-1 are compared.

All patients in this study were subjected to CDP and changes in post-operative serum direct and total bilirubin are noticed. This is consistent with the results of other similar studies.

The intra-abdominal pressure in our study was  $12.9 \pm 1.72$  mm Hg which is higher than the normal portal venous pressure of 7 – 10mmHg. This leads to reduction in portal blood flow and lead to alterations in liver function..

Prolonged use of diathermy to the liver surface in laparoscopic cholecystectomy and the spread of heat to liver parenchyma result in local effects in rise of hepatic enzymes. This hypothesis is supported by some studies. Tauro LF, Sheethal CM et.al explained the squeeze pressure effect on the liver may be another possible mechanism for alterations of serum liver enzymes after laparoscopic cholecystectomy. The traction of the gall bladder may free the liver enzymes into the blood stream.<sup>8</sup>

According Rikki Singal et al From the disturbances in liver function tests are not related to the age or sex in relation to laparoscopy. Due to the squeeze pressure effect on the liver, the traction & shearing effect of the gall bladder might result in LFT changes after laparoscopic cholecystectomy<sup>9</sup>.

According to Dr. Geetha K. Adhvani showed increase in Serum Bilirubin after Laparoscopic Appendicectomy, Laparoscopic Umbilical Hernia mesh repair and Laparoscopic cholecystectomy. These changes in the Serum Bilirubin may be due to the Pneumoperitoneum rather than thermal injury to the liver, shearing force to gall bladder which will not occur in Laparoscopic Appendicectomy & Laparoscopic Umbilical Hernia mesh repair<sup>6</sup>.

In our study, there is significant rise in serum total and direct bilirubin following laparoscopic cholecystectomy on postoperative day 1 with p value <0.001 and transient decrease to near normal on post operative day 3.

The CDP was above than the pressure in portal venous system which is used for laparoscopic procedure. This pressure disrupts portal circulation and decreases portal flow up to 50%, which causes a basement of the hepatic reticular endothelial system<sup>10</sup>. In this study also, there is elevation of intraabdominal pressure resulting in increased levels serum bilirubin but no significant rise in serum bilirubin with increase in duration of pressure.

The elevation and depression of intra-abdominal pressure in a small period during the laparoscopic surgery leads to sudden alteration of intra-abdominal pressure that would affect the portal blood flow. This re-creation of blood flow and organs would lead to ischemia and re-creation damage of organs and tissues, mainly the kupffer and endothelial cells of hepatic sinusoids". This can cause free-radical generation"<sup>6</sup>.

These changes in Serum Bilirubin are transient as the values revert back to near pre-operative values by Post Op day-3. Hence Laparoscopic procedures can be safely performed in the absence of serious Liver disorders. However further studies are required in this regard.

### Conclusion

In our study, that there was a transient elevation of serum bilirubin in Laparoscopic Cholecystectomy due to short-term reduction in hepatic blood flow caused by CO<sub>2</sub> pneumoperitoneum. No apparent clinical changes were seen in the patients. Since its benefits overcome its limitations, Laparoscopic surgery is emerging to be a gold standard for various surgical conditions. It is concluded that it is safe to perform Laparoscopic procedures in the presence of healthy liver.

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