Effect of CO2 Pneumoperitoneum on Liver Function Tests after Laparoscopic Surgery.

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Abstract: Laparoscopic surgery has become the choice of treatment for many abdominal surgeries. It reduces the complications of open abdominal surgeries but it has its own pitfalls. Pneumoperitoneum is to be created for maneuvering the instruments within the abdominal cavity. CO2 is the most common gas used to create pneumoperitoneum. Our study aims to determine the effect of CO2 pneumoperitoneum on Liver function tests(LFT) before and after surgery. A total of 100 patients were included in the study and their mean LFT values were compared with the post-operative day 2 LFT values. Serum bilirubin, SGOT, SGPT, ALP were elevated after the surgery and the difference is statistically significant at $p<0.05$. CO2 pneumoperitoneum causes elevation of the LFTs in patients undergoing laparoscopic surgery.

Key words: Liver function tests, Laparoscopic surgery, LFT, Pneumoperitoneum, Adverse effects.

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Introduction:

Access to the peritoneal cavity for diagnosis and numerous surgical procedures that were previously only possible through laparotomy is now made possible by laparoscopy. Its benefits are well-known and include less post-operative discomfort, a shorter hospital stay, and better cosmetic outcomes. Laparoscopic surgery has made it simple to treat some diseases that were previously left untreated out of concern for access-related damage to nearby structures. The management of patients with impalpable testes, gallbladder disease, and Hirschsprung's disease have all greatly benefited from laparoscopy(1). However, the procedure may take longer than expected and the pneumoperitoneum increases intra-abdominal pressure while continuously compressing internal organs, which may have an impact on hepatic microcirculatory perfusion. Concern has been expressed about the local and systemic effects of increased intra-abdominal pressure during laparoscopic procedures due to the observation of hemodynamic and metabolic impairment linked to Carbon dioxide (CO2) pneumoperitoneum and postoperative mesenteric ischemia reports following

laparoscopic procedures. It has been postulated that CO2 pneumoperitoneum causes increase in the Liver function test (LFT) values due to its various effects post-operatively. Understanding the impact of CO2 pneumoperitoneum on LFT values in patients undergoing laparoscopic surgery is the goal of this study(2).

Aims and Objectives:

To assess the effect of CO2 pneumoperitoneum on the LFTs by comparing the levels of Serum Bilirubin, AST, ALT, and Alkaline Phosphatase in patients undergoing laparoscopic surgeries preoperatively and postoperatively on day 2.

Materials and Methods: This is a prospective study conducted over a period of 1 year at Govt. Siddhartha Medical College, Vijayawada. 100 patients of the 18-60 years age group undergoing elective laparoscopic surgery were considered in the study. Pregnants and patients with pre-existing liver illnesses were excluded from the study. LFT values were evaluated before the surgery and on the post-operative day, 2 and the values were compared. Data were analyzed using an excel sheet. The study abides by the guidelines laid by the declaration of helensky. Informed and written consent was taken from all the participants.

Results:

The mean age of the study population was 43.5 ± 3.6 years. Males were 56 and Females were 44. The most common surgery undergone was laparoscopic cholecystectomy followed by hernioplasty. The mean duration of surgery was 100.8 ± 12.6 minutes. The mean serum bilirubin at pre-operative period was 0.73 mg/dL and 1.16 mg/dL on post-operative day 2. The mean SGPT was 19.34 and 32.2 IU/L during pre-operative and post-operative day 2 respectively. The mean SGOT values pre-operatively and at post-operative day 2 was 22.9 IU/L and 38.5 IU/L. The mean ALP values pre-operatively and post-operatively day 2 was 100.2 and 132.6 IU/L respectively. The difference in all the four parameters between pre-operative period and post-operative day 2 was statistically significant with p-value < 0.05 (Independent T-test). The results have been summarized in the table no. 1.

Table no.1

Test	Pre-operative (mean)	Post-operative day 2 (mean)	p-Value
Serum Bilirubin (mg/dL)	0.73	1.16	0.038
SGPT (IU/L)	19.34	32.2	0.01

SGOT (IU/L)	22.9	38.5	0.02
ALP (IU/L)	100.2	132.6	0.01

Discussion:

In order to retain operative mobility and provide enough surgical exposure during laparoscopy, pneumo peritoneum must be established. However, inhaling carbon dioxide into the peritoneal cavity can have an impact on a number of homeostatic mechanisms, altering blood gases, the acid-base balance, and cardiovascular and pulmonary physiology(3). While healthy people might manage these changes well, patients with pre-existing diseases may experience higher physiologic stress, increasing their risk for perioperative problems. Identification of high-risk patients and development of appropriate treatment regimens, which may include preoperative cardiorespiratory optimization and perioperative monitoring, depend on a thorough understanding of the physiologic alterations brought on by carboperitoneum. Under ideal circumstances, weak patients should be able to safely withstand pneumoperitoneum and then benefit from minimally invasive surgery(4).

In clinical practice, CO2 has been utilized to induce pneumoperitoneum from the early stages of lap cholecystectomy. When CO2 enters the systemic circulation after being absorbed from the peritoneal surface, hypercarbia and eventually systemic acidosis may result. Pneumoperitoneum causes an increase in intra-abdominal pressure, which alters the hemodynamics and affects the function of the kidneys, liver, heart, and lungs(5,6).

Halevy et al. were the first to observe and analyse changes in liver enzymes following laparoscopic cholecystectomy in 1994. The primary causes were determined to be: 1. An increase in intra-abdominal pressure; 2. A compressive effect on the liver during retraction; 3. Lateral spread of diathermy and gall bladder retraction; and 4. A spill of small calculi in CBD(7).

A 2007 study by Omari et al. examined the impact of CO2 pneumoperitoneum on liver function tests. In 142 consecutive patients who underwent laparoscopic cholecystectomy (LC), 23 patients who underwent open cholecystectomy (OC), and 25 patients who underwent a traditional hernial repair, the serum levels of eight liver function parameters were measured before and 24 hours after surgery. All patients in the various groups received the same anaesthetic protocol, and in the case of LC, the intra-abdominal pressure was kept at 12 mmHg of CO2. In patients who underwent LC, all eight parameters were statistically different 24 hours after surgery, with the exception of alkaline phosphatase, whereas only 3 patients in the OC group experienced changes in alanine aminotransferase and aspartate aminotransferase, and 2

patients experienced elevated levels of direct bilirubin, and no changes were noticed in patients who underwent conventional hernial repair. We discovered that 83% of the patients had at least one parameter increase by more than 100%, 43% had two or more parameters increase, and 23% had three or more parameters increase. All patients with LC had significantly lower levels of total proteins and albumin, as well, according to our observations(8).

In order to determine the impact of CO2 pneumoperitoneum on liver function tests, Hiremath et al. did a study in 2016. An open-label, prospective study of the Indian population was conducted. The study involved 50 cholecystectomy patients from Karnataka who had laparoscopic cholecystectomy while maintaining constant intraperitoneal pressure (14 mmHg). The goal of the study was to assess the risks associated with laparoscopic cholecystectomy, particularly the changes in liver enzymes. Total bilirubin was 0.510 0.286 mg/dl pre-operatively; 24 hours later, it had increased by 134% to 0.684 0.239 mg/dl (P = 0.000). From 0.221 0.129 mg/dl to 0.372 0.203 mg/dl, bilirubin (direct) increased by 168%. Gamma-glutamyl transferase (GGT) went from 45.13 19.14 U/l to 46.37 19.08, with a P value of 0.046. The levels of the enzymes aspartate aminotransferase (AST) and alanine aminotransferase (ALT) were significantly increased from 22.68 7.031 U/l to 32.74 7.731 U/l and from 33.61 10.40 U/l to 56.10 15.08 U/l, respectively (P = 0.000). Alkaline phosphatase readings did not increase; they were 72.62 14.36 U/l before surgery and 71.81 12.60 U/l after 24 hours (P = 0.350)(9).

Conclusion:

There is a statistically significant difference between LFT levels before and after surgery in patients undergoing laparoscopic surgery with CO2 pneumoperitoneum.

Limitations: Small sample size and other factors that might have affected the LFTs were not excluded.

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