

# High and low-pressure carbon dioxide in patients undergoing laparoscopic cholecystectomy

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## ABSTRACT

**Background:** *Laparoscopic cholecystectomy is considered the gold standard for gallbladder removal and is the most common laparoscopic procedure worldwide. The present study was conducted to compare high and low-pressure carbon dioxide in patients undergoing laparoscopic cholecystectomy.*

**Materials & Methods:** *86 patients undergoing laparoscopic cholecystectomy of both genders were classified into 2 groups of 43 each. Group I comprised of high-pressure carbon dioxide and group II low pressure carbon dioxide. In both groups, abdominal pain, nausea and vomiting were evaluated on the verbal rating scale (VRS) at 1, 3, 6, 12, and 24 hours.*

**Results:** *The mean nausea/vomiting score at 1 hour, 3 hours, 6 hours, 12 hours and 24 hours in group I and II was 5.6, 5.0, 4.5, 3.8 and 3.2 and 4.2, 3.4, 3.0, 2.6 and 2.0 respectively. The mean abdominal pain in group I was 7.5, 6.5, 6.0, 5.4 and 4.6 and in group II was 6.8, 4.6, 5.2, 3.6 and 2.2 in group I. The mean shoulder tip pain was 6.2, 5.4, 4.6, 3.8 and 2.4 in group I and 6.0, 4.8, 4.4, 3.6 and 1.8 in group II respectively. The mean pre-operative ALT level in group I was 20.5 and post-operative level was 40.5 and in group II was 20.4 and 45.6. AST level found to be 21.4 and 38.2 and in group II was 20.4 and 45.3, ALP level was 185.4 and 170.5, BILTT level was 0.62 and 0.70 in group I and 0.61 and 0.69 in group II, BILLD level was 0.21 and 0.34 in group I and 0.23 and 0.35 in group II respectively. The difference was significant ( $P < 0.05$ ).*

**Conclusion:** *Low pressure group had less pain score and nausea and vomiting score as compared to high pressure group. Hence, it can be considered as treatment of choice in patients undergoing laparoscopic cholecystectomy.*

**Key words:** *laparoscopic cholecystectomy, Low pressure, Shoulder pain*

## Introduction

The gallstone is a common complication of biliary tract, and since 1882 surgery is the best common traditional method to remove it. Almost 10 % of the population has gallstones, and cholecystectomy is the most common surgical method to treat it in the Western countries. However, today, the laparoscopic cholecystectomy (LC) is the gold standard to treat gallstones. It was introduced by Dubois in 1988 and gradually developed by monitor and video systems. The following advantages of this surgical procedure have encouraged patients and surgeons toward it: short cuts, short hospital stay, less side-effects, lower post-surgery pain, rapid return to normal activities, and mortality less than 1 %.<sup>1</sup>

Surgery of the gallbladder has evolved tremendously over the past decades. Laparoscopic cholecystectomy is considered the gold standard for gallbladder removal and is the most common laparoscopic procedure worldwide.<sup>2</sup> The tendency of minimising surgical trauma encourages the use of new approaches in laparoscopic surgery. In recent times, the innovative techniques of natural orifice transluminal endoscopic surgery (NOTES) and single incision laparoscopic surgery (SILS) have been applied in gallbladder removal as a step forward toward nearly scarless surgery.<sup>3</sup>

Nowadays, surgeons use gases with 7–10 mmHg pressure instead of the standard pressure. Using lower-pressure gases for the elderly and patients with chronic respiratory and cardiovascular diseases obtain good results.<sup>4</sup> Less shoulder-tip pain and increasing the quality of life after the surgery are other advantages of this method. On the other hand, using lower-pressure gases limits clear viewing of surgical site, prolongs the surgery time, and increases the complications which may lead the surgeon to use standard pressure and open surgery.<sup>5</sup> The present study was conducted to compare high and low-pressure carbon dioxide in patients undergoing laparoscopic cholecystectomy.

### Materials & Methods

The present study comprised of 86 patients undergoing laparoscopic cholecystectomy of both genders. All were informed regarding the study and their written consent was obtained.

Data such as name, age, gender etc. was recorded. Patients were classified into 2 groups of 43 each. Group I comprised of high-pressure carbon dioxide and group II low pressure carbon dioxide. In both groups, abdominal pain, nausea and vomiting were evaluated on the verbal rating scale (VRS) at 1, 3, 6, 12, and 24 hours. The level of liver enzymes such as aspartate transaminase (AST), alanine transaminase (ALT), alkaline phosphatase (ALP), and bilirubin (BIL) were assessed. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

### Results

**Table I Distribution of patients**

Groups	Group I	Group II
Status	high-pressure carbon dioxide	low pressure carbon dioxide
M:F	23:20	25:18

Table I shows that group I had 23 males and 20 females and group II had 25 males and 18 females.

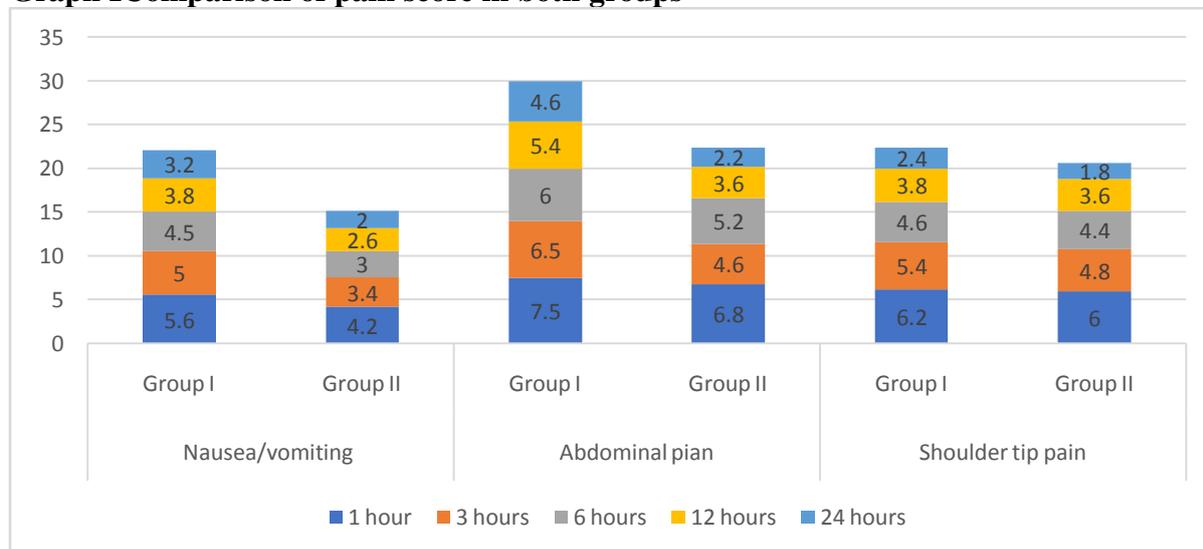
**Table II Comparison of pain score in both groups**

Parameters	Variables	1 hour	3 hours	6 hours	12 hours	24 hours	P value
Nausea/vomiting	Group I	5.6	5.0	4.5	3.8	3.2	0.05
	Group II	4.2	3.4	3.0	2.6	2.0	
Abdominal pain	Group I	7.5	6.5	6.0	5.4	4.6	0.02
	Group II	6.8	4.6	5.2	3.6	2.2	
Shoulder tip pain	Group I	6.2	5.4	4.6	3.8	2.4	0.04
	Group II	6.0	4.8	4.4	3.6	1.8	

Table II, graph I shows that mean nausea/vomiting score at 1 hour, 3 hours, 6 hours, 12 hours and 24 hours in group I and II was 5.6, 5.0, 4.5, 3.8 and 3.2 and 4.2, 3.4, 3.0, 2.6 and 2.0 respectively. The mean abdominal pain in group I was 7.5, 6.5, 6.0, 5.4 and 4.6 and in group

II was 6.8, 4.6, 5.2, 3.6 and 2.2 in group I. The mean shoulder tip pain was 6.2, 5.4, 4.6, 3.8 and 2.4 in group I and 6.0, 4.8, 4.4, 3.6 and 1.8 in group II respectively. The difference was significant ( $P < 0.05$ ).

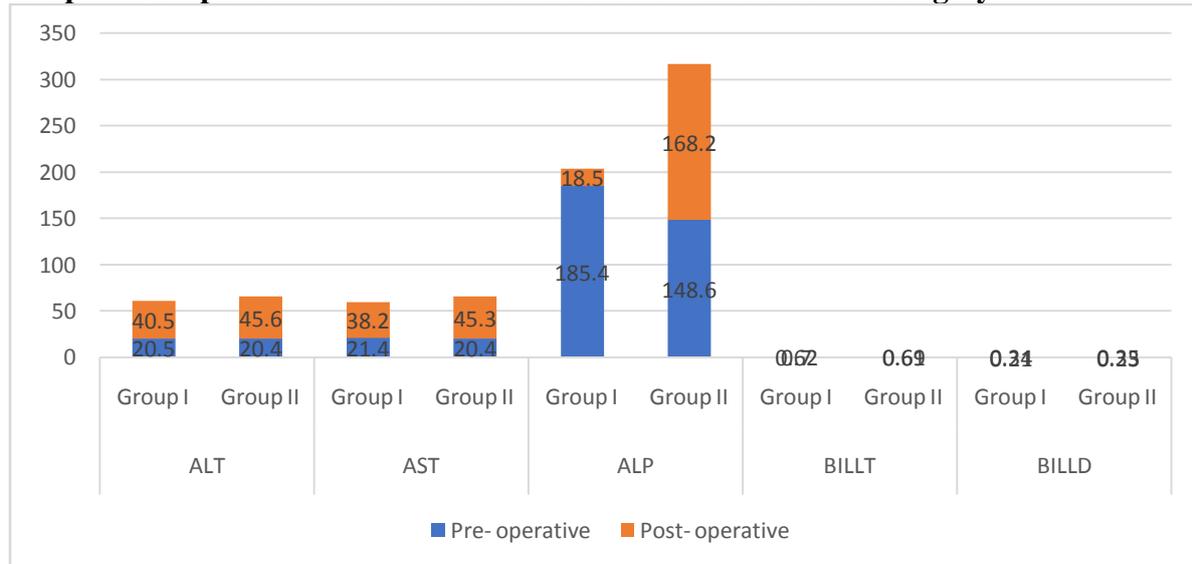
**Graph I Comparison of pain score in both groups**



**Table III Comparison of liver function tests before and after the surgery**

LFT	Groups	Pre- operative	Post- operative	P value
ALT	Group I	20.5	40.5	0.04
	Group II	20.4	45.6	
AST	Group I	21.4	38.2	0.05
	Group II	20.4	45.3	
ALP	Group I	185.4	170.5	0.03
	Group II	148.6	168.2	
BILLT	Group I	0.62	0.70	0.02
	Group II	0.61	0.69	
BILLD	Group I	0.21	0.34	0.05
	Group II	0.23	0.35	

Table III, graph II shows that mean pre- operative ALT level in group I was 20.5 and post-operative level was 40.5 and in group II was 20.4 and 45.6. AST level found to be 21.4 and 38.2 and in group II was 20.4 and 45.3, ALP level was 185.4 and 170.5, BILLT level was 0.62 and 0.70 in group I and 0.61 and 0.69 in group II, BILLD level was 0.21 and 0.34 in group I and 0.23 and 0.35 in group II respectively. The difference was significant ( $P < 0.05$ ).

**Graph II Comparison of liver function tests before and after the surgery**

## Discussion

Cholelithiasis is one of the most common digestive tract diseases and constitutes an important health problem in developed countries. It is estimated that 10-15% of the adult population accounting for 20 to 25 million Americans have or will have gallstones.<sup>6</sup> The third National Health and Nutrition Assessment estimates that 6.3 million of men and 14.2 million of women aged between 20 and 74 years in the United States had gallbladder diseases.<sup>7</sup> Besides the problems related to health, cholelithiasis also brings significant costs, estimated at around 6.2 million dollars annually in the same country.<sup>10</sup> About 750,000 patients undergo cholecystectomy per year in the United States, and the number of surgical procedures has grown increasingly over the years, with the purpose to avoid the symptoms, complications and recurrence of gallstones in the biliary tract.<sup>11</sup>

We found that group I had 23 males and 20 females and group II had 25 males and 18 females. Mohammadzade et al<sup>12</sup> compared the hemodynamic symptoms and the level of abdominal pain due to using high and low-pressure carbon dioxide in patients undergoing LC. The current double-blind randomized clinical trial was conducted on 60 patients with the age range of 20–70 years old undergoing LC. The first and second groups experienced PaCO<sub>2</sub> of 7–10 and 12–14 mmHg, respectively. The hemodynamic symptoms, abdominal pain, shoulder-tip pain, nausea and vomiting after the surgery, and the mean of liver function tests were evaluated. Information of 60 patients in two groups was analyzed. There was a significant difference between the groups regarding the mean of systolic blood pressure ( $P < 0.05$ ). The mean of heart rate was significantly higher in the high-pressure group during surgery and 1 h after that ( $P < 0.05$ ). The frequency of pain in shoulder-tip and abdomen was higher in the high-pressure group. Frequency of nausea and vomiting 12 h after the surgery between two groups was significant ( $P < 0.05$ ). The mean of alkaline phosphatase was higher in the low-pressure group than the high-pressure group ( $P < 0.05$ ). The present study was conducted to compare high and low-pressure carbon dioxide in patients undergoing laparoscopic cholecystectomy.

We found that mean nausea/vomiting score at 1 hour, 3 hours, 6 hours, 12 hours and 24 hours in group I and II was 5.6, 5.0, 4.5, 3.8 and 3.2 and 4.2, 3.4, 3.0, 2.6 and 2.0 respectively. The mean abdominal pain in group I was 7.5, 6.5, 6.0, 5.4 and 4.6 and in group II was 6.8, 4.6, 5.2, 3.6 and 2.2 in group I. The mean shoulder tip pain was 6.2, 5.4, 4.6, 3.8 and 2.4 in group I and 6.0, 4.8, 4.4, 3.6 and 1.8 in group II respectively. In the study by Vesakis<sup>13</sup> that compared the level of pain between the low-pressure and without pressure groups, there was

no significant difference regarding the level of abdominal pain between the groups; but because of prolonged surgery, the shoulder-tip pain was more in the highpressure group.

We found that mean pre- operative ALT level in group I was 20.5 and post- operative level was 40.5 and in group II was 20.4 and 45.6. AST level found to be 21.4 and 38.2 and in group II was 20.4 and 45.3, ALP level was 185.4 and 170.5, BILLT level was 0.62 and 0.70 in group I and 0.61 and 0.69 in group II, BILLD level was 0.21 and 0.34 in group I and 0.23 and 0.35 in group II respectively. In another study by Al-Dabbagh<sup>14</sup> on the level of post-operative pain in patients undergoing LC, patients were categorized in two groups as low-pressure of 8 mmHg and high-pressure of 12 mmHg. Comparing the post-operative pain between the groups showed that the level of 4, 8, 12, and 24 h post-operative pain in abdomen and shoulders were lower in the low-pressure group, and the significant difference was observed between them (P = 0.01).

### Conclusion

Authors found that low pressure group had less pain score and nausea and vomiting score as compared to high pressure group. Hence, it can be considered as treatment of choice in patients undergoing laparoscopic cholecystectomy.

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