

## ORIGINAL RESEARCH

### **A comparative analysis of high- and low-pressure carbon dioxide pneumoperitoneum in patients undergoing laparoscopic cholecystectomy (LC)**

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#### **ABSTRACT**

**Background:** The laparoscopic cholecystectomy (LC) is the gold standard to treat gallstones. The present study was conducted to compare high- and low-pressure carbon dioxide pneumoperitoneum in patients undergoing laparoscopic cholecystectomy (LC).

**Materials & Methods:** 80 patients undergoing laparoscopic cholecystectomy were divided into 2 groups of 40 each. In group I, the pneumoperitoneum with PaCO<sub>2</sub> of 7–10 mmHg and in group II with 12–14 mmHg using standard four-port method was used. Abdominal pain at the site of surgery and shoulder-tip pain were assessed based on the verbal rating scale (VRS). Parameters such as arterial blood pressure, heart rate, and body temperature were recorded during and 1 hour, 6 hours, 12 hours and 24 hours after the surgery.

**Results:** The mean abdominal pain was 7.8, 6.3, 5.2 and 4.5 and in group II 6.4, 4.1, 5.0 and 2.9 at 1 hour, 6 hours, 12 hours and 24 hours in group I and group II respectively. Nausea/vomiting score was 5.9, 4.5, 3.8 and 2.5 in group I and 4.7, 3.7, 2.6 and 2.1 in group II respectively. Shoulder tip pain in group I was 6.4, 4.6, 3.7 and 2.9 in group I and 6.0, 4.4, 3.2 and 1.9 in group II respectively. The difference was significant ( $P < 0.05$ ).

**Conclusion:** Low pressure pneumoperitoneum was found to be better than high pressure pneumoperitoneum in patients with laparoscopic cholecystectomy.

**Key words:** Laparoscopic cholecystectomy, Pneumoperitoneum, CO<sub>2</sub>

#### **INTRODUCTION**

The laparoscopic cholecystectomy (LC) is the gold standard to treat gallstones. The short cuts, short hospital stay, less side-effects, lower post-surgery pain, rapid return to normal activities, and mortality less than 1% are advantages of it.<sup>1</sup>

Increased intra-abdominal pressure affects venous return, systemic vascular resistance and myocardial function. Pneumoperitoneum and Trendelenberg position cause cephalad shift of diaphragm decreasing functional residual capacity and pulmonary compliance, increases airway resistance and airway pressure and thus increases risk of baro-trauma.<sup>2</sup> It also impairs renal function and reduces urine output due to increased renal vascular resistance and reduced

glomerular filtration rate. Recovery after laparoscopic cholecystectomy depends upon several factors such as abdominal pain, shoulder tip pain, nausea, vomiting and fatigue.<sup>3</sup> These side-effects are due to peritoneal stretching and diaphragmatic irritation caused by high intra-abdominal pressure and by CO<sub>2</sub>.<sup>4</sup> Keeping this in mind, it was assumed that lower intra-abdominal pressure will decrease these complications. Traditionally, the pressure used to create pneumoperitoneum is around 15mm of Hg.<sup>5</sup> There are a few studies done using low pressure pneumoperitoneum (less than 12 mm of Hg) and showed decrease in pain post-operatively. But, all the studies are not unequivocal in this respect.<sup>6</sup> The present study was conducted to compare high- and low-pressure carbon dioxide pneumoperitoneum in patients undergoing laparoscopic cholecystectomy (LC).

## MATERIALS & METHODS

The present study comprised of 80 patients undergoing laparoscopic cholecystectomy (LC) of both genders. All gave their written consent to participate in the study.

Data such as name, age, gender etc. was recorded. Patients were divided into 2 groups of 40 each. In group I, the pneumoperitoneum with PaCO<sub>2</sub> of 7–10 mmHg and in group II with 12–14 mmHg using standard four-port method was used. Abdominal pain at the site of surgery and shoulder-tip pain were assessed based on the verbal rating scale (VRS). Parameters such as arterial blood pressure, heart rate, and body temperature were recorded during and 1 hour, 6 hours, 12 hours and 24 hours after the surgery. Data thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

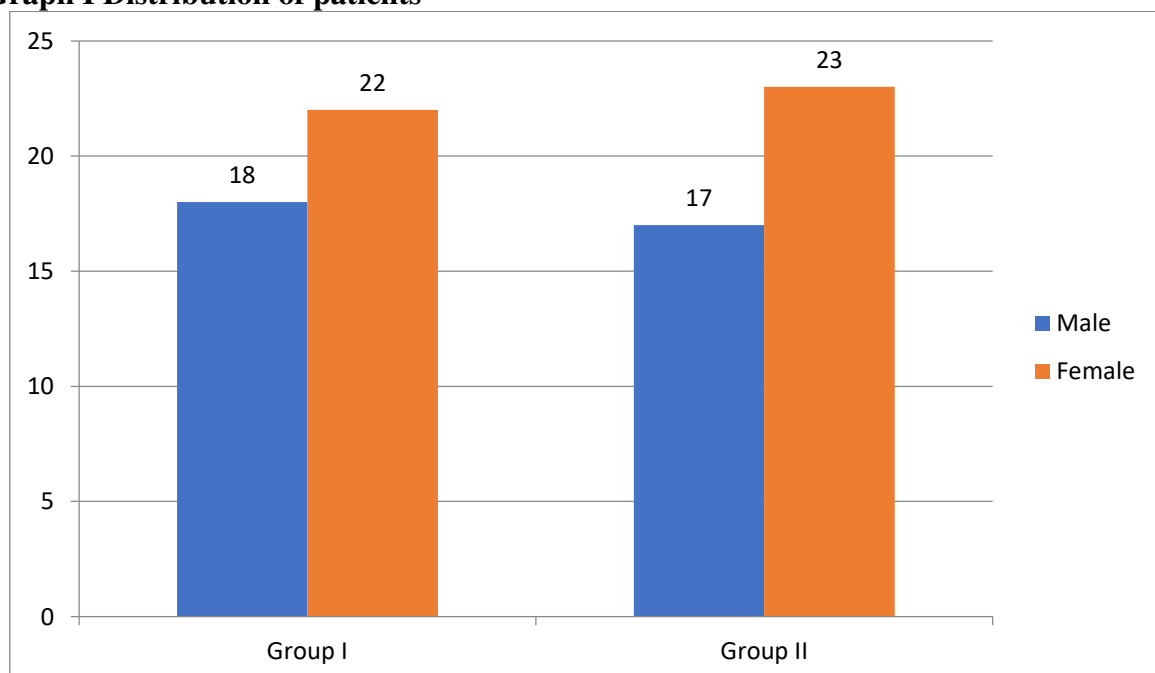
## RESULTS

**Table I Distribution of patients**

Groups	Group I	Group II
Method	High pressure CO <sub>2</sub> with pneumoperitoneum	Low pressure CO <sub>2</sub> with pneumoperitoneum
M:F	18:22	17:23

Table I, graph I shows that group I had 18 males and 22 females and group II had 17 males and 23 females.

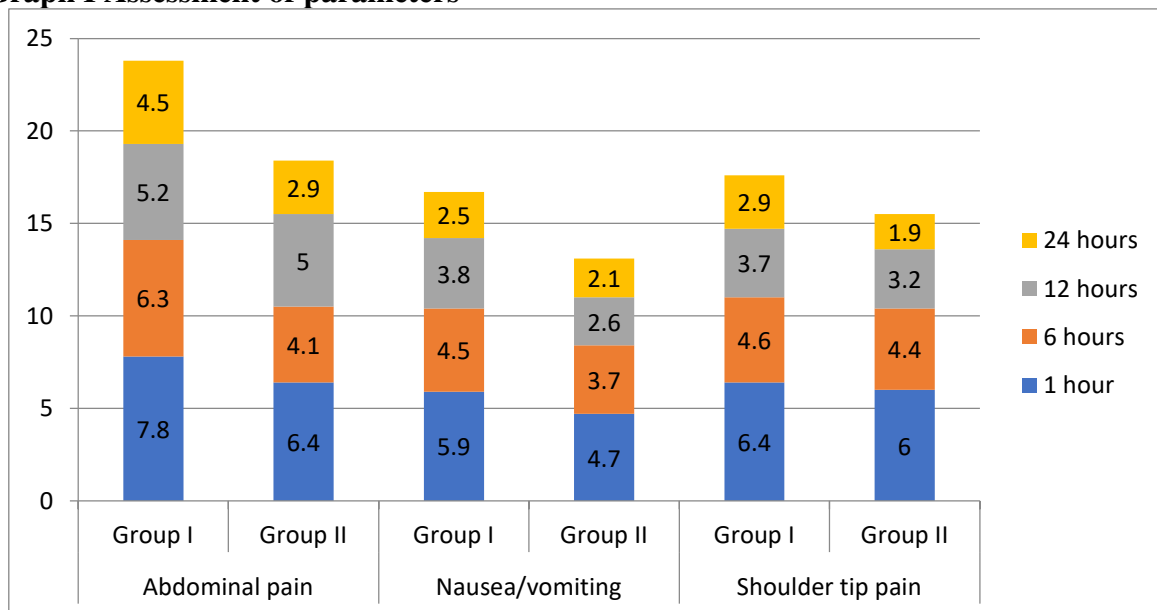
**Graph I Distribution of patients**



**Table II Assessment of parameters**

Parameters	Variables	1 hour	6 hours	12 hours	24 hours	P value
Abdominal pain	Group I	7.8	6.3	5.2	4.5	0.04
	Group II	6.4	4.1	5.0	2.9	
Nausea/vomiting	Group I	5.9	4.5	3.8	2.5	0.03
	Group II	4.7	3.7	2.6	2.1	
Shoulder tip pain	Group I	6.4	4.6	3.7	2.9	0.05
	Group II	6.0	4.4	3.2	1.9	

Table II, graph II shows that mean abdominal pain was 7.8, 6.3, 5.2 and 4.5 and in group II 6.4, 4.1, 5.0 and 2.9 at 1 hour, 6 hours, 12 hours and 24 hours in group I and group II respectively. Nausea/vomiting score was 5.9, 4.5, 3.8 and 2.5 in group I and 4.7, 3.7, 2.6 and 2.1 in group II respectively. Shoulder tip pain in group I was 6.4, 4.6, 3.7 and 2.9 in group I and 6.0, 4.4, 3.2 and 1.9 in group II respectively. The difference was significant ( $P < 0.05$ ).

**Graph I Assessment of parameters**

## DISCUSSION

The gallstone is a common complication of biliary tract, and since 1882 surgery is the best common traditional method to remove it.<sup>7</sup> Almost 10 % of the population has gallstones and cholecystectomy is the most common surgical method to treat it in the Western countries. Laparoscopy is a minimally invasive surgery which is nowadays preferred to open surgery.<sup>8</sup> Laparoscopic surgeries are associated with better maintenance of hemostasis compared to open surgeries due to top benefits such as more rapid hospital discharge, less post-operative complications, and lower costs.<sup>9,10</sup> The present study was conducted to compare high- and low-pressure carbon dioxide pneumoperitoneum in patients undergoing laparoscopic cholecystectomy (LC).

We found that group I had 18 males and 22 females and group II had 17 males and 23 females. Yashwashi et al<sup>11</sup> enrolled 101 patients of laparoscopic cholecystectomy which were divided into low-pressure 8 mm Hg (Group A) and high-pressure 14 mm Hg (Group B) carbon dioxide pneumoperitoneum groups. The mean age of group A was 45 years and for group B it was 45.75 years. Most common indication for surgery was symptomatic gall stone disease. Baseline ONSD in group A was  $0.427 \pm 0.0459$  mm, whereas it was  $0.412 \pm 0.0412$  mm in group B. There was a significant rise of ONSD 30 minutes after induction of

pneumoperitoneum and up to 30 min post anesthesia. In the low-pressure group 7 (14%) patients had a significant rise of ICP, whereas in the high-pressure group 20 (39%) patients had a significant rise of ICP.

We observed that mean abdominal pain was 7.8, 6.3, 5.2 and 4.5 and in group II 6.4, 4.1, 5.0 and 2.9 at 1 hour, 6 hours, 12 hours and 24 hours in group I and group II respectively. Nausea/vomiting score was 5.9, 4.5, 3.8 and 2.5 in group I and 4.7, 3.7, 2.6 and 2.1 in group II respectively. Shoulder tip pain in group I was 6.4, 4.6, 3.7 and 2.9 in group I and 6.0, 4.4, 3.2 and 1.9 in group II respectively. Singla et al<sup>12</sup> compared the effect of low pressure and standard pressure pneumoperitoneum in post laparoscopic cholecystectomy pain. 100 ASA grade I & II patients were divided into two groups -50 each. Group A patients underwent laparoscopic cholecystectomy with low pressure pneumoperitoneum while group B underwent laparoscopic cholecystectomy with standard pressure pneumoperitoneum. Both the groups were compared for pain intensity, analgesic requirement and complications. Post-operative pain score was significantly less in low pressure group as compared to standard pressure group. Number of patients requiring rescue analgesic doses was more in standard pressure group. This was statistically significant. Also total analgesic consumption was more in standard pressure group. There was no difference in intraoperative complications.

Mohammadzade AR<sup>13</sup> compared the hemodynamic symptoms and the level of abdominal pain due to using high- and low-pressure carbon dioxide in patients undergoing LC. 60 patients were divided into 2 groups as 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. There was a significant difference between the groups regarding the mean of systolic blood pressure. The mean of heart rate was significantly higher in the high-pressure group during surgery and 1 hour after. The frequency of pain in shoulder-tip and abdomen was higher in the high-pressure group. Frequency of nausea and vomiting 12 hours after the surgery between two groups was significant. The mean of alkaline phosphatase was higher in the low-pressure group than the high-pressure group. Considering the good performance and low side effects of low-pressure laparoscopic cholecystectomy compared to those of high-pressure, this method can be replaced by high-pressure in LC.

## CONCLUSION

Authors found that Low pressure pneumoperitoneum was found to be better than high pressure pneumoperitoneum in patients with laparoscopic cholecystectomy.

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