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

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Abstract

Background: About 10% of the population has gallstones and cholecystectomy is the most common surgical method to treat it. The present study was conducted to compare high- and low-pressure carbon dioxide in patients undergoing laparoscopic cholecystectomy (LC).

Materials & Methods: 94 patients undergoing laparoscopic cholecystectomy (LC) of both genders were divided into 2 groups. In group I, the pneumoperitoneum with PaCO₂ of 7–10 mm Hg and in group II with 12–14 mm Hg using standard four-port method was used. In all patients, abdominal pain, shoulder-tip pain and nausea and vomiting was recorded.

Results: Group I had 16 males and 21 females and group II had 17 males and 20 females. The mean abdominal pain at 1 hour, 6 hours, 12 hours and 24 hours in group I was 7.6, 6.2, 5.1 and 4.2 and in group II was 6.3, 4.2, 5.0 and 2.7 respectively. Nausea/vomiting score was 5.8, 4.3, 3.7 and 2.4 in group I and 4.6, 3.6, 2.7 and 2.0 in group II respectively. Shoulder tip pain in group I was 6.3, 4.5, 3.5 and 2.8 and in group II was 6.1, 4.3, 3.1 and 1.7 respectively. The difference was significant ($P < 0.05$).

Conclusion: Low pressure pneumoperitoneum was superior as compared to high pressure pneumoperitoneum in laparoscopic cholecystectomy patients.

Keywords: Gall stone, laparoscopic cholecystectomy, pneumoperitoneum

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. 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 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.

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. It also impairs renal function and reduces urine output due to increased renal vascular resistance and reduced glomerular filtration rate.

One more important haemodynamic change that occurs is the transient reduction in hepatic blood flow which can be known by assessing the liver function tests. Elevation of liver enzymes such as AST and Alanine Aminotransferase (ALT) after non-complicated laparoscopic cholecystectomy is not the rare finding. The probable aetiology is explained to be a transient hepatic malfunction due to decreased blood flow to liver. The present study was conducted to compare high- and low-pressure carbon dioxide in patients undergoing laparoscopic cholecystectomy (LC).

Materials & Methods

The present study comprised of 94 patients undergoing laparoscopic cholecystectomy (LC) of both genders. The consent was obtained from all enrolled patients.

Data such as name, age, gender etc. was recorded. Patients were divided into 2 groups. In group I, the pneumoperitoneum with PaCO₂ of 7–10 mm Hg and in group II with 12–14 mm Hg using standard four-port method was used.

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In all patients, arterial blood pressure, heart rate, and body temperature were recorded during and 1 hour, 6 hours, 12 hours and 24 hours after the surgery. Abdominal pain at the site of surgery and shoulder-tip pain were assessed based on the verbal rating scale (VRS) where no pain = 0, moderate pain = 1, medium pain = 2, severe pain = 3, and intractable pain = 4. The level of nausea and vomiting were also recorded such as no nausea and vomiting = 0, slight nausea and vomiting = 1, need for anti-nausea drug = 2, and intractable vomiting = 3. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

Results

Table 1: Distribution of patients

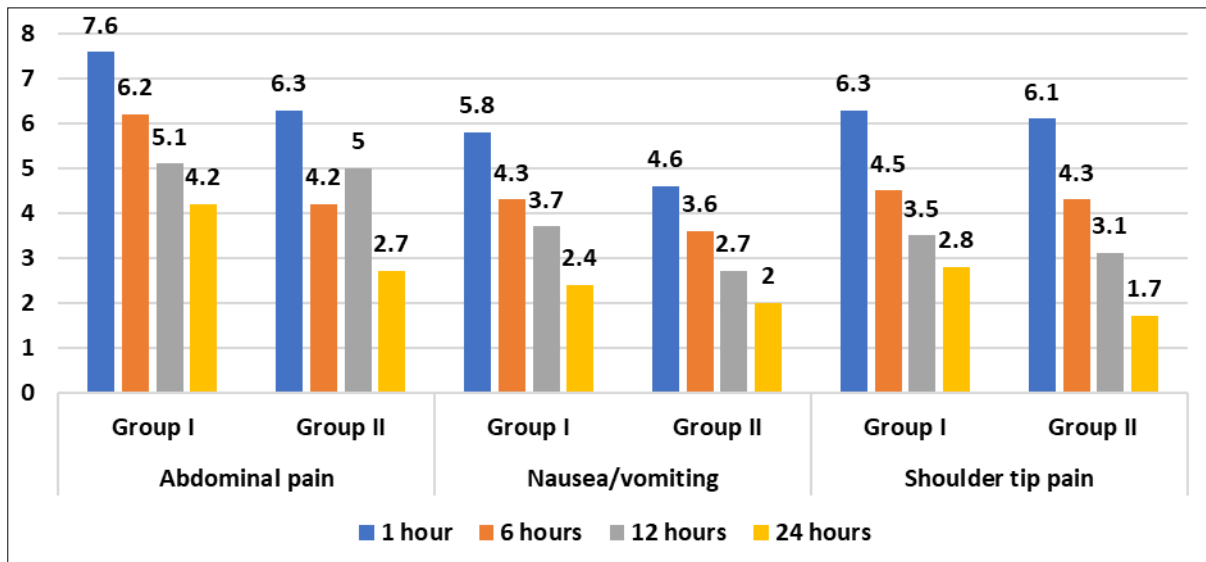
Groups	Group I	Group II
Method	pneumoperitoneum with PaCO ₂ of 7–10 mm Hg	pneumoperitoneum with PaCO ₂ of 12–14 mm Hg
M:F	16:21	17:20

Table I shows that group I had 16 males and 21 females and group II had 17 males and 20 females.

Table 2: Assessment of parameters

Parameters	Variables	1 hour	6 hours	12 hours	24 hours	P value
Abdominal pain	Group I	7.6	6.2	5.1	4.2	0.01
	Group II	6.3	4.2	5.0	2.7	
Nausea/vomiting	Group I	5.8	4.3	3.7	2.4	0.05
	Group II	4.6	3.6	2.7	2.0	
Shoulder tip pain	Group I	6.3	4.5	3.5	2.8	0.04
	Group II	6.1	4.3	3.1	1.7	

Table II, graph I shows that mean abdominal pain at 1 hour, 6 hours, 12 hours and 24 hours in group I was 7.6, 6.2, 5.1 and 4.2 and in group II was 6.3, 4.2, 5.0 and 2.7 respectively. Nausea/vomiting score was 5.8, 4.3, 3.7 and 2.4 in group I and 4.6, 3.6, 2.7 and 2.0 in group II respectively. Shoulder tip pain in group I was 6.3, 4.5, 3.5 and 2.8 and in group II was 6.1, 4.3, 3.1 and 1.7 respectively. The difference was significant (P < 0.05).



Graph I: Assessment of parameters

Discussion

Laparoscopy is a minimally invasive surgery which is nowadays preferred to open surgery. 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. Also, there is lower post-operative pain in laparoscopic surgeries compared to open ones. Laparoscopy is widely used in many surgeries; one of them is LC. One of the common complications of laparoscopy is the hemodynamic changes during peritoneal insufflation of carbon dioxide associated with decreased cardiac output, increased systemic vascular resistance, hypertension, heart rate changes, reduced respiratory capacity, and increased airway pressure. The present study was conducted to compare high- and low-pressure carbon dioxide in patients undergoing laparoscopic cholecystectomy (LC).

We found that group I had 16 males and 21 females and group II had 17 males and 20 females. Aggarwal *et al* assessed the impact of high pressure and low pressure pneumoperitoneum in selected group of patients undergoing laparoscopic cholecystectomy. Sixty patients with confirmed diagnosis of chronic cholecystitis with cholelithiasis undergoing laparoscopic cholecystectomy were randomised into two groups. Group I- in which low pressure pneumoperitoneum (14 mm of Hg) was used

intra-operatively. There was no significant difference in bilirubin and ALP in both the groups but serum Aspartate Aminotransferase (AST) and Alkaline phosphatase (ALP) were raised significantly postoperatively in group II patients. Operative time, hospital stay and time to return to normal routine was less in group I postoperatively but this was statistically non-significant.

We observed that mean abdominal pain at 1 hour, 6 hours, 12 hours and 24 hours in group I was 7.6, 6.2, 5.1 and 4.2 and in group II was 6.3, 4.2, 5.0 and 2.7 respectively. Nausea/vomiting score was 5.8, 4.3, 3.7 and 2.4 in group I and 4.6, 3.6, 2.7 and 2.0 in group II respectively. Shoulder tip pain in group I was 6.3, 4.5, 3.5 and 2.8 and in group II was 6.1, 4.3, 3.1 and 1.7 respectively. Mohammadzade AR aimed to compare 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 PaCO₂ 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 ($P < 0.05$). The mean of heart rate was significantly higher in the high-pressure group during surgery and 1 hour 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 ($P < 0.05$). 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.

Singh SP *et al.* [12] compared the hemodynamic and capnographic changes in the low pressure (<8mm Hg) and standard pressure (12-14mm Hg) LC. In this randomized case control study, Group A included patients undergoing Low pressure LC (<8mm Hg). In group B, Standard pressure LC (12-14mmHg) was performed. Both groups were evaluated for the hemodynamic and capnographic changes and other parameters. Difference in mean heart rate of Group A and Group B was found to be statistically significant at 10 min after induction. After 30 minutes of surgery, systolic blood pressure of Group B was found to be higher than that of Group A ($p < 0.05$). Differences in diastolic blood pressure among patients of Group A and Group B were found to be statistically significant only at 30 min and 40 min after induction. Except at 30 min after induction, differences in EtCO₂ levels of patients of Group A and Group B were found to be statistically significant. They concluded that it appears that low pressure pneumoperitoneum appears to be having fewer effects on blood pressure- both systolic and diastolic, as compared to standard pressure pneumoperitoneum in patients undergoing LC. It also appears to be causing fewer derangements in EtCO₂. This may help in smooth recovery and less post-operative problems.

Conclusion

Authors found that low pressure pneumoperitoneum was superior as compared to high pressure pneumoperitoneum in laparoscopic cholecystectomy patients.

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