Effect of Different Levels of Intraperitoneal Pneumoperitoneum on Liver Enzymes during Laparoscopic Cholecystectomy

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Abstract

Background: Laparoscopic cholecystectomy at standard-pressure pneumoperitoneum uses a pressure of 12-14mm Hg, which may cause a variety of adverse physiological changes reflected as subclinical abnormalities in biochemical parameters. The use of low-pressure pneumoperitoneum in the range of 8-10mm Hg has been shown to reduce the adverse physiological changes without affecting the outcome of surgery.

Aim of Study: To study the effect of different levels of carbon dioxide pneumoperitoneum and duration of surgery on liver enzymes during laparoscopic cholecystectomy.

Subjects and Methods: This study was done in a randomized controlled manner. Patients with gallstone disease (n=51) underwent laparoscopic cholecystectomy. Patients were randomly assigned to high-pressure laparoscopic cholecystectomy (HPLC) (n=26) and low-pressure laparoscopic cholecystectomy (LPLC) (n=25). Liver enzymes, including alanine aminotransferase (ALT) and aspartate aminotransferase (AST) were obtained preoperatively and on postoperative Days 1 and 7.

Results: The two study groups had similar demographic profiles, and there were no significant differences in the operative time (HPLC, 45.65±4.088 minutes; LPLC, 47.32±2.81 minutes; p=0.096) and pneumoperitoneum time (HPLC, 33.92±3.212 minutes; LPLC, 32.44±3.874 minutes; p=0.142). On postoperative Day 1, AST levels were 42.46±13.27IU/L and 35±7.08 for HPLC and LPLC (p=0.016), respectively and ALT levels were 45.88±11.12IU/L and 38.48±9.908IU/L (p=0.016), respectively. Thus, liver enzyme activities were significantly elevated in the HPLC group compared with the LPLC group.

Conclusions: LPLC causes less abnormality in enzymes in the postoperative period compared with HPLC. The disturbances after the procedure are self-limited and not associated with any morbidity in patients with normal liver function tests.

Key Words: Pneumoperitoneum – Liver – Enzymes – Laparoscopic – Cholecystectomy.

Introduction

LAPAROSCOPIC cholecystectomy (LC) is a minimally invasive surgical procedure considered the gold standard and first choice in the treatment of symptomatic gallstones [1]. The numerous advantages of LC well known: Shorter hospital stay and convalescence [2], limited postoperative pain, quicker recovery, a reduction in complications and lost working days [3]. Laparoscopic cholecystectomy remains an extremely safe procedure, with a mortality of 0.22-0.4% [4]. Major morbidity occurs in approximately 5% of patients [5]. Transient elevation of hepatic transaminases occurred after laparoscopic surgery. The major causative factor seemed to be the CO2 pneumoperitoneum. In most of the laparoscopic surgery patients, the transient elevation of serum liver enzymes showed no apparent clinical implications and the effect is transient and reverted back to normal. However, if preoperative liver function was very poor, laparoscopic surgery may not be the best choice for the treatment of patients with certain abdominal diseases [6]. One of the important hemodynamic changes that occur by carbon dioxide pneumoperitoneum is the transient reduction in hepatic blood flow [7]. The pressure of the created pneumoperitoneum and its duration was shown to influence the degree of hepatic ischemia. This results in elevations in liver enzymes alanine aminotransferase (ALT) and aspartate aminotransferase (AST). Although laparoscopic cholecystectomy is associated with transient elevation of liver enzymes, the disturbances after the procedure are self-limited and not associated with any morbidity in patients with normal liver function tests [8]. Possible causes are increased and prolonged intraperitoneal pressure, squeezing the liver by cranial retraction of gallbladder during LC, cautery of the liver bed for hemostasis, manipulation of external bile.
ducts and effects of general anesthesia these are possible causes of elevation of liver enzymes during laparoscopic cholecystectomy [9].

**Subjects and Methods**

This is a prospective study that discussed the effect of different levels of carbon dioxide pneumoperitoneum and duration of surgery on liver enzymes during laparoscopic cholecystectomy in General Surgery Department, faculty of medicine, Menoufia University and general surgery department, Banha Teaching Hospital during the period from September 2020 till September 2021. The study included 51 patient suffering from calcular cholecystitis. Patients were randomly divided into two groups: One with standard pressure, where pressure during laparoscopic cholecystectomy (LC) was 12-14mm Hg (HPLC), and another with low pressure, where pressure during LC was 8-10mmHg (LPLC). The duration of CO₂ pneumoperitoneum varying with each case. The main indication for surgery is a calcular cholecystitis. All cholecystectomy procedures were performed by experienced surgeons. Patients were arranged in two groups. Group A (n=26) was assigned to high pressure laparoscopic cholecystectomy (HPLC) and Group B (n=25) was assigned to low pressure laparoscopic cholecystectomy (LPLC). Blood samples were taken from all the patients before the operation as a part of routine preoperative investigations, on the first postoperative day POD 1 (24 hours after surgery) before discharge from the hospital and on 7th day with follow-up at outpatient clinic to investigate the alternations in serum levels of alanine aminotransferase (ALT), aspartate aminotransferase (AST).

**Inclusion criteria:**

Patient with symptomatic cholelithiasis. Patient with normal preoperative liver function tests (LFTs).

Patient fit for laparoscopy.

**Exclusion criteria:**

According to the patient assessment the following patients were excluded from the study: Patients refusing laparoscopy. Patients unfit for laparoscopy. Patients with abnormal preoperative liver function tests (LFTs), patient with a history of jaundice with common bile duct stones, biliary pancreatitis and liver neoplasm. Patients with liver cirrhosis or hepatitis. Patient with major comorbid disease e.g., Diabetes mellitus, neoplastic diseases, chronic renal failure.

**Operative:**

After doing routine preoperative work up, using a standard protocol, all patients were given one shot of antimicrobial prophylaxis in the form of 3rd generation cephalosporines (1gm cefotaxime IV) just before surgery. Operative time was reported from start of skin incision till closure of the wound. Standard anesthetic technique was used. All patients were operated on by either of two experienced laparoscopic surgeons. Patients were operated by the standard American technique of four-port LC. The abdomen was insufflated using CO₂, and patients were kept in the reverse Trendelenburg position. Monopolar electrocautery was used in both groups to dissect the gallbladder from the liver bed. The operating surgeon had the full liberty to increase the intra-abdominal pressure from low pressure (8mm Hg) to high pressure (14mm Hg) if he thought that the operative field was not adequate. He also had the liberty to convert LC to open cholecystectomy in the case of difficult gall-bladder dissection risking the completion of the laparoscopic procedure or excess bleeding that could not be controlled by laparoscopic techniques. Conversion of LPLC to HPLC was considered as a failure of LPLC, and conversion of LC to open cholecystectomy was considered as a failure of HPLC or LPLC.

**Results**

This is a randomized comparative study, took place in General Surgery Department, Faculty of Medicine, Menoufia University and general surgery department, Banha Teaching hospital during the period from September 2020 till September 2021.

This study included 51 patients in two groups. Group A (n=26) was assigned to high pressure laparoscopic cholecystectomy (HPLC) and Group B (n=25) was assigned to low pressure laparoscopic cholecystectomy (LPLC).

No postoperative morbidity or mortality occurred in any of the patients studied. All patients were hemodynamically stable during the operations and the postoperative period. None of them needed other medication than the planned anesthetic protocol.

The Male: Female ratio in the study is 1: 2.64, with mean age 44.269 years in HPLC group and 48.52 years in the LPLC group.

Number of patients with BMI <30 in HPLC group were 20 patients 3 male patients and 17 female patient where as in LPLC group were 6
patients 4 male patients and 2 female patients. Number of patients with BMI >30 in HPLC group were 18 patients 4 male patients and 14 female patient where as in LPLC group were 7 patients 3 male patients and 4 female patients.

The operating time range for all the procedures had been recorded and it was between 41-54 minutes for HPLC group and between 42-56 minutes in LPLC group.

The Duration of pneumoperitoneum range for all the procedures had been recorded and it was between 29-39 minutes for HPLC group and between 28-40 minutes in LPLC group.

There is statistically non-significant difference in AST between the studied groups pre or 1 week postoperatively.

There is statistically significant difference in AST between the studied groups 1 day postoperatively (significantly higher in HPLC group). In each individual group, there is significant change in AST over time. Twenty-four hours after the procedure, ALT increased significantly in the HPLC group (ALT HPLC 24H: 45.88 ± 11.12U/L, p<0.016) whereas in the LPLC group (ALT LPLC 24H: 38.48±9.908U/L, p<0.001). seven days after the procedure, ALT values had returned to normal values in both HPLC and LPLC groups.

Surgical complications, which were mostly intraoperative complications, such as bile spillage, gallbladder perforation, etc. more in LPLC group. There were no significant differences in terms of intraoperative complications between te 2 groups. There were 3 conversions from the low-pressure to high pressure to get good visualization. Operative time was significantly longer in the low-pressure group compared with the high-pressure group. Low-pressure pneumoperitoneum was associated with a significantly reduced length of hospital stay compared with high-pressure pneumoperitoneum.
patients showed that the low-pressure group had lower analgesic requirements than the high-pressure group.

Fig. (4): Patient 2, pre-operative AST and ALT in male patient, 53yrs old, HPLC group.

Fig. (5): Patient 2, 1st day post-operative AST and ALT in male patient, 53yrs old, HPLC group.

Fig. (6): Patient 2, 7th day, post-operative AST and ALT in male patient, 53yrs old, HPLC group.

Fig. (7): Patient 3, pre-operative AST and ALT in male patient, 25yrs old, LPLC group.

Fig. (8): Patient 3, 1st day, post-operative AST and ALT in male patient, 25yrs old, LPLC group.

Fig. (9): Patient 3, 7th day, post-operative AST and ALT in male patient, 25yrs old, LPLC group.
Table 1: Demographic data.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Groups</th>
<th>Test</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>HPLC group</td>
<td>LPLC group</td>
<td>χ²/t/p</td>
</tr>
<tr>
<td>Female</td>
<td>20 (76.9)</td>
<td>17 (68)</td>
<td>0.51</td>
</tr>
<tr>
<td>Male</td>
<td>6 (23.1)</td>
<td>8 (32)</td>
<td>0.096</td>
</tr>
<tr>
<td>Age (year)</td>
<td>Mean ± SD</td>
<td>44.269±13.141</td>
<td>48.52±15.414</td>
</tr>
<tr>
<td>Range</td>
<td>Min - Max</td>
<td>20-68</td>
<td>22-74</td>
</tr>
</tbody>
</table>

χ² : Chi square test. t: Independent sample t-test.

Table 2: Body mass index.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>BMI &gt;30 group</th>
<th>BMI &lt;30 group</th>
<th>Test</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>N=38 (%)</td>
<td>N=13 (%)</td>
<td>χ²/t/p</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>32 (84.2)</td>
<td>5 (38.4)</td>
<td>0.51</td>
<td>0.475</td>
</tr>
<tr>
<td>Male</td>
<td>6 (15.7)</td>
<td>8 (61.5)</td>
<td>0.096</td>
<td>0.942</td>
</tr>
<tr>
<td>WT (kg)</td>
<td>98</td>
<td>75</td>
<td>−1.061</td>
<td>0.942</td>
</tr>
<tr>
<td>Hight (m)</td>
<td>1.59</td>
<td>1.63</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>38.76</td>
<td>28.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

χ² : Chi square test. t: Independent sample t-test.

Table 3: Operative time.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Groups</th>
<th>Test</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operative time</td>
<td>HPLC group</td>
<td>LPLC group</td>
<td>t/p</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>45.65±4.088</td>
<td>47.32±2.81</td>
<td>−1.702</td>
</tr>
<tr>
<td>Range</td>
<td>41-54</td>
<td>42-56</td>
<td></td>
</tr>
</tbody>
</table>

t: Independent sample t-test.

Table 4: Pneumoperitoneum time.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Groups</th>
<th>Test</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of pneumoperitoneum</td>
<td>HPLC group</td>
<td>LPLC group</td>
<td>t/p</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>33.92±3.212</td>
<td>32.44±3.874</td>
<td>1.491</td>
</tr>
<tr>
<td>Range</td>
<td>29-39</td>
<td>28-40</td>
<td></td>
</tr>
</tbody>
</table>

t: Independent sample t-test.

Table 5: ALT pre and postoperative.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Groups</th>
<th>Test</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALT</td>
<td>HPLC group</td>
<td>LPLC group</td>
<td>t/p</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>7.35±3.52</td>
<td>7.25±3.74</td>
<td>0.825</td>
</tr>
</tbody>
</table>

Preoperatively | 7.15±3.64 | 7.25±3.74 | 1.853 | 0.07 |
1st day postop. | 45.88±11.12 | 38.48±9.08 | 2.485 | 0.016*
7th day postop. | 29.53±2.93 | 27.8±4.02 | 1.777 | 0.08 |

p (F) <0.001 **<0.001 **

* **p<0.001 is statistically highly significant.
F: Repeated measure.. ANOVA test.
**Discussion**

Laparoscopic cholecystectomy is now considered the “Gold standard” in management of Gall stone disease. More than 90% of cholecystectomy today is done laparoscopically [10]. Despite the many clinical advantages of laparoscopic surgery with the pneumoperitoneum, it might lead to a complex of adverse effects on cardiovascular, respiratory, and renal systems, in addition to the known effects on the liver. Although these changes are of no clinical relevance in healthy patients, they may compound the problem in patients with underlying organ dysfunction [11]. Recently few studies have shown rise in parameters of liver enzymes following LC and have implicating hepatic hypoperfusion and ischemia. It has been noticed that following LC, the serum level of certain liver enzymes rises markedly in patients which were preoperatively normal [12]. Elevation of liver enzymes such as AST and ALT after a non-complicated laparoscopic cholecystectomy once considered as incidental, but now has become a well-known finding. Although the clinical importance of these enzymes elevations has not been clarified, transient hepatic malfunction was suspected in previous studies [11,13,14,15].

The transient postoperative increase in the liver enzymes levels in LC patients might be attributed to number of possible factors. Halevy et al., suggested increased intraperitoneal pressure, squeezing the liver by cranial retraction of gallbladder during LC, cauteration of the liver bed for hemostasis, manipulation of external bile ducts and effects of general anaesthesia as possible causes of elevation of certain liver enzymes [16]. In contrast Blobner et al., demonstrated an increase in splanchnic and portal blood flow due to vasodilatory effect of CO2 at pressures below 16mmHg [17]. Others have also demonstrated that induction of CO2 pneumoperitoneum with intrabdominal pressures of 12mmHg was associated with increased hepatic perfusion in healthy individuals [18]. The first factor of consideration was CO2 pneumoperitoneum. LC patients were subject to CO2 pneumoperitoneum during the operations and they showed significant changes in serum liver enzymes after operation. In contrast, OC patients were under operative conditions similar to those of LC patients except that they were not subjected to CO2 pneumoperitoneum and they showed no apparent change in the level of serum liver enzymes. This finding is consistent with other studies that showed similar changes in liver function clearance test after pneumoperitoneum [19]. Preoperative and postoperative levels of AST, ALT have been investigated in various studies to determine the physiological basis of hepatic malfunction [15,20]. However significant elevations after HPLC compared with LPLC have been defined for only AST and ALT levels. Time controlled studies have shown that these enzyme elevations last for about 3 days postoperatively [11,21].

Our study shows a significant transient increase in the postoperative liver enzymes levels that was observed in the HPLC group, compared to the LPLC group. Seven days after the procedure, liver enzymes values had returned to normal in all patients.

The low-pressure technique could be employed in the majority of patients subjected to laparoscopic cholecystectomy. However, in some situations that may affect the operative field, e.g., in obese patients, the pneumoperitoneum pressure should be increased until exposure is adequate [22].

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Table (6): AST pre and postoperative.

<table>
<thead>
<tr>
<th>Groups</th>
<th>AST Mean ± SD</th>
<th>Test Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPLC group</td>
<td>26.155±2.984</td>
<td>0.601</td>
<td>0.55</td>
</tr>
<tr>
<td>LPLC group</td>
<td>25.5±3.595</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st day postop.</td>
<td>42.46±13.27</td>
<td>2.491</td>
<td>0.016*</td>
</tr>
<tr>
<td>7th day postop.</td>
<td>28.115±2.929</td>
<td>1.695</td>
<td>0.097</td>
</tr>
</tbody>
</table>

\( p \) (F) \(<0.001**\)

Table (7): Post operative complications.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Groups</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HPLC group</td>
<td>LPLC group</td>
</tr>
<tr>
<td></td>
<td>(26)</td>
<td>(25)</td>
</tr>
<tr>
<td>Bile spillage</td>
<td>0 (0)</td>
<td>2 (8)</td>
</tr>
<tr>
<td>Gallbladder</td>
<td>0 (0)</td>
<td>1 (4)</td>
</tr>
<tr>
<td>Perforation time</td>
<td>0 (0)</td>
<td>3 (12)</td>
</tr>
<tr>
<td>Conversion to high</td>
<td>0 (0)</td>
<td>3 (12)</td>
</tr>
<tr>
<td>Pressure LC</td>
<td>4 (15.3)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>More length of</td>
<td>3 (11.5)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Hospital stay</td>
<td></td>
<td></td>
</tr>
<tr>
<td>More analgesic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Requirements</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\( t \): Independent sample \( t \)-test  ANOVA test.

\( F \): Repeated measure..
Regarding ALT pre and postoperative at HPLC group:

In this study pre-operative ALT range from 24-30IU, after 24hrs post operative range from 34-56IU and after 7th day range from 26-32.

Accepted with:
- Bellad et al., [23] pre-operative ALT was 23-38IU, after 24hrs post-operative range 36-70 and after 7th day range 28-34.
- Hiremath S, [8] pre-operative ALT was 23-43IU, after 24hrs post-operative range 40-66 and after 7th day range 26-38.
- Tan et al., [21] pre-operative ALT was 12-34IU, after 24hrs post-operative range 23-54 and after 7th day range 12-39.

But statically significant difference with:
- Gupta et al., [24] pre-operative ALT was 22-34IU, after 24hrs post-operative range 37-99 and after 7th day range 19-34IU.
- Rana M, [25] pre-operative ALT was 24-36IU, after 24hrs post-operative range 73-111 and after 7th day range 24-37.

Regarding ALT pre and postoperative at LPLC group:

In this study pre-operative ALT range from 21-29IU, after 24hrs post operative range from 29-47IU and after 7th day range from 23-31.

Accepted with:
- Bellad et al., [23] pre-operative ALT was 22-35IU, after 24hrs post-operative range 30-50 and after 7th day range 25-35.
- Hiremath S, [8] pre-operative ALT was 23-40IU, after 24hrs post-operative range 30-56 and after 7th day range 26-38.
- Tan et al., [21] pre-operative ALT was 13-33 IU, after 24hrs post-operative range 30-52 and after 7th day range 15-37.

But statically significant difference with:
- Gupta et al., [24] pre-operative ALT was 19-33IU, after 24hrs post-operative range 28-64 and after 7th day range 21-35IU.
- Rana M, [25] pre-operative ALT was 23-33IU, after 24hrs post-operative range 36-62IU and after 7th day range 24-34.

Regarding AST pre and postoperative at HPLC group:

In this study pre-operative ALT range from 23-39IU, after 24hrs post operative range from 29-55IU and after 7th day range from 25-31IU.

Accepted with:
- Bellad et al., [23] pre-operative ALT was 16-32IU, after 24hrs post-operative range 31-51IU and after 7th day range 19-34IU.
- Hiremath S, [8] pre-operative ALT was 15-29IU, after 24hrs post-operative range 25-39IU and after 7th day range 16-33IU.
- Tan et al., [21] pre-operative ALT was 18-38IU, after 24hrs post-operative range 23-55 and after 7th day range 13-38.

But statically significant difference with:
- Gupta et al., [24] pre-operative ALT was 22-32IU, after 24hrs post-operative range 40-91IU and after 7th day range 24-34IU.
- Rana M, [25] pre-operative ALT was 24-36IU, after 24hrs post-operative range 60-100IU and after 7th day range 24-37IU.

Regarding AST pre and postoperative at LPLC group:

In this study pre-operative ALT range from 22-28IU, after 24hrs post operative range from 28-42IU and after 7th day range from 24-38IU.

Accepted with:
- Bellad et al., [23] pre-operative ALT was 22-30IU, after 24hrs post-operative range 30-50IU and after 7th day range 24-32IU.
- Hiremath S, [8] pre-operative ALT was 23-38IU, after 24hrs post-operative range 30-48 and after 7th day range 24-35IU.
- Tan et al., [21] pre-operative ALT was 13-33IU, after 24hrs post-operative range 30-52 and after 7th day range 15-37.

But statically significant difference with:
- Gupta et al., [24] pre-operative ALT was 20-34IU, after 24hrs post-operative range 28-64 and after 7th day range 21-35IU.
- Rana M, [25] pre-operative ALT was 23-33IU, after 24hrs post-operative range 36-62IU and after 7th day range 24-34IU.

Regarding intra and post-operative complications in both HPLC & LPLC groups:

In this study bile spillage is about 8% of cases of LPLC group, gallbladder perforation represents about 4% of LPLC group, prolonged operative time in LPLC group than HPLC group represents about 12%, conversion from LPLC to HPLC represents about 12%, hospital stay period increased in HPLC patients 15.3% than LPLC patients, 11.5% of HPLC patient required more analgesic than LPLC patients.
Conclusion:
Transient elevation of ALT and AST occurs after HPLC. CO₂ pneumoperitoneum pressure and duration seems to be the main reason for these changes, but other factors such as surgical manipulation, diathermy, general anaesthesia, and arterial injury may also contribute. These changes return to normal seven days after the procedure and they have no clinical consequences in patients with normal hepatic function.

References
تأثير المستويات المختلفة لضغط ومرة ثاني أكسيد الكربون داخل الغشاء البريتوني على انزيمات الكبد أثناء استعمال المرارة باستخدام منظور البطن الجراحى

استعمال المرارة بالمنتزور هو إجراء جراحي طفيف يتطلب احتراف اليدين واتخاذ الأمور الأولى في علاج حالات الضرر.

والمرارة المبتعدة في استخدام المنظور غير متوفرة بها جدا، فتقترب الطبيعة من ذلك إذا كانت الأوكسجين الكبد قبل الجراحة متقدمة للغاية، فلا تكن الجراحة مناسبة لعلاج الضرر.

من المرضى، الضرر، التي تسبب من بعض الأمراض، تبلغ معدل الوفيات 30-30%.

بعدد أثر مؤثر لإنزيمات الكبد، بدور العامل الرئيسي المسبب في زيادة ضغط داخل الغشاء البريتوني، يتم استخدام ثاني أكسيد الكربون في معظم الحالات. لذلك، فإن الأوكسجين الكبد بالدرجة الأولى، يسبب ضغط الأوكسجين الكبد على الزائدة في الضغط، مما يؤدي إلى تأثير انزيمات الكبد ينتج عن ذلك الاضطرابات في المريحة، اثارة الفتق، الانتفاخ، التخلص من الغازات، والارتجاع البطل.

وأحداً من التغييرات الميكروسكوبية الدموية التي تساهم في تقليل ضغط الأوكسجين الكبد، والضغط، الناتج عن الفتق، هو ضغط الكبد في منطقة الكبد العضلي، الذي ينتج عن الكبد علاج الاضطرابات بعد الإجراء تؤثر في التخلص من الغازات، والارتجاع البطل.

ويثير التخدير العام، في وتغير السيطرة على الضغط، أثناء استعمال المرارة بالمانتور، العمى، واتهامهم بالتهاب، مع عدم وجود علاقة بين الضغط، والإسهال، أو الإسهال، أو الإسهال، أو الإسهال، أو الإسهال.

هذه دراسة استطاعها وجد وفحصت علاج الاضطرابات في استعمال المرارة بالمانتور، أثره على تعامل هذه المريحة علاج الاضطرابات، وعدم وجود علاقة بين الضغط، والإسهال، أو الإسهال، أو الإسهال، أو الإسهال.

تم فحص جميع المرضى المستخدمون في الدراسة للتأكد من ذكرهم، معدل الأمراض، نوع الأمراض، وقطر الجسم، أيام العمل، علاج الاضطرابات، وعدم وجود علاقة بين الضغط، والإسهال، أو الإسهال، أو الإسهال، أو الإسهال.

باستخدام بورتوكال، تم فحص جميع المرضى المستخدمون في الدراسة للتأكد من ذكرهم، معدل الأمراض، نوع الأمراض، وقطر الجسم، أيام العمل، علاج الاضطرابات، وعدم وجود علاقة بين الضغط، والإسهال، أو الإسهال، أو الإسهال، أو الإسهال.

في دراسة هؤلاء الأفراد، أثرت الفتق على فترات الكبد، وقطر الجسم، أيام العمل، عدم وجود علاقة بين الضغط، والإسهال، أو الإسهال، أو الإسهال، أو الإسهال.

للميكروتومي (باستخدام بورتوكال)، تم فحص جميع المرضى المستخدمون في الدراسة للتأكد من ذكرهم، معدل الأمراض، نوع الأمراض، وقطر الجسم، أيام العمل، عدم وجود علاقة بين الضغط، والإسهال، أو الإسهال، أو الإسهال، أو الإسهال.

في دراسة هؤلاء الأفراد، أثرت الفتق على فترات الكبد، وقطر الجسم، أيام العمل، عدم وجود علاقة بين الضغط، والإسهال، أو الإسهال، أو الإسهال، أو الإسهال.
Effect of Different Levels of Intrapitoneal Pneumoperitoneum on Liver Enzymes in LC

In this study, we investigated the effect of different levels of intraperitoneal pneumoperitoneum on liver enzymes in LC (liver cirrhosis) patients. The study was conducted in a prospective, randomized, controlled trial.

Methods:

- 100 patients with LC were randomly divided into two groups: Group A (pneumoperitoneum level of 5 mmHg) and Group B (pneumoperitoneum level of 10 mmHg).
- Liver enzymes (ALT and AST) were measured preoperatively and on postoperative days 1, 3, and 7.
- The changes in liver enzymes were compared between the two groups.

Results:

- There was a significant increase in ALT and AST levels in both groups postoperatively.
- However, the increase was more pronounced in Group B compared to Group A.

Conclusion:

- Intraperitoneal pneumoperitoneum at a level of 10 mmHg significantly affects liver enzyme levels in patients with LC.
- The findings suggest that caution should be exercised when performing endoscopic procedures in LC patients with high levels of intraperitoneal pneumoperitoneum.