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EVALUATION OF POST-OPERATIVE SHOULDER TIP PAIN IN LOW-PRESSURE (10MMHG CO_2) VERSUS STANDARD- PRESSURE (14MMHG CO_2) PNEUMOPERITO-NEUM IN LAPAROSCOPIC CHOLECYSTECTOMY

Kunal Kailas Jadhav

Associate Professor, Department of Surgery, Rural Medical College and Hospital, Loni

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Corresponding Author:

Kunal Kailas Jadhav

Associate Professor, Department of Surgery, Rural Medical College and Hospital, Loni

ABSTRACT

Laparoscopic cholecystectomy (LC) is a common procedure for treating gallbladder diseases, but post-operative shoulder tip pain (STP) remains a frequent issue, mainly caused by diaphragmatic irritation from carbon dioxide (CO_2) pneumoperitoneum. This study compares post-operative STP between low-pressure (10mmHg CO_2) and standard-pressure (14mmHg CO_2) pneumoperitoneum. A randomized trial of 200 patients was conducted, with pain assessed using a Visual Analogue Scale (VAS) at 6, 12, 24, and 48 hours postoperatively. The low-pressure group showed a statistically significant reduction in STP, without affecting surgical outcomes such as operative time or complications. This study suggests that low-pressure pneumoperitoneum can reduce post-operative STP and improve patient comfort following LC.

Keywords: Shoulder tip pain, low-pressure pneumoperitoneum, laparoscopic cholecystectomy, CO_2 insufflation, post-operative pain

INTRODUCTION

Laparoscopic cholecystectomy (LC) has become the standard treatment for symptomatic cholelithiasis due to its minimal invasiveness, reduced post-operative pain, and faster recovery compared to open surgery. However, one common post-operative issue is shoulder tip pain (STP), which is reported in up to 80% of cases and is typically referred from diaphragmatic irritation caused by CO_2 insufflation during surgery (1,2).

Pneumoperitoneum is essential for creating adequate space for visualization and manipulation during laparoscopic procedures. Standard pressure for CO_2 insufflation is usually between 12 and 15mmHg, but this has been associated with increased post-operative discomfort, particularly in the form of shoulder tip pain (3). The exact mechanism of STP is thought to involve phrenic nerve irritation from residual CO_2 trapped under the diaphragm (4). Reducing the insufflation pressure to 10mmHg has been proposed as a means of mitigating this pain, while still maintaining sufficient surgical exposure (5,6).

Several studies have investigated the effects of low-pressure pneumoperitoneum on various post-operative outcomes, including pain, recovery time, and complications. Some evidence suggests that lower pressures may reduce the incidence and severity of post-operative pain, but the impact on shoulder tip pain specifically remains understudied (7). Additionally, concerns have been raised about whether lower pressure might compromise surgical safety or prolong operative times (8).

This study aims to compare the incidence and severity of post-operative shoulder tip pain between patients undergoing LC with low-pressure (10mmHg) versus standard-pressure (14mmHg) pneumoperitoneum, while also assessing secondary outcomes such as operative time and complications (9). The findings will help guide optimal pressure settings to improve patient comfort without sacrificing surgical efficiency.

Aim:

To evaluate post-operative shoulder tip pain in patients undergoing laparoscopic cholecystectomy with low-pressure (10mmHg CO_2) versus standard-pressure (14mmHg CO_2) pneumoperitoneum.

Objectives:

1. To compare the incidence and severity of post-operative shoulder tip pain between the two groups.
2. To assess the impact of pneumoperitoneum pressure on operative time, complications, and patient satisfaction.

Material and Methods:

This prospective, randomized study was conducted over one year at a tertiary care hospital. A total of 200 patients scheduled for elective laparoscopic cholecystectomy for symptomatic gallstone disease were enrolled. Patients were randomly assigned to either the low-pressure pneumoperitoneum group (10mmHg CO_2) or the standard-pressure group (14mmHg CO_2) (10). Inclusion criteria were patients aged 18-65 years with no contraindications to laparoscopic surgery. Patients with chronic pain conditions, previous upper abdominal surgeries, or contraindications for pneumoperitoneum were excluded (11).

Post-operative shoulder tip pain was assessed using a Visual Analogue Scale (VAS) at 6, 12, 24, and 48 hours. Secondary outcomes included operative time, intra-operative complications, and overall recovery time (12). Statistical analysis was performed using the student's t-test, with $p < 0.05$ considered significant.

Results:

Table 1

Time After Surgery	Low-Pressure Group (10mmHg) (VAS Score)	Standard-Pressure Group (14mmHg) (VAS Score)	p-value
6 hours	3.5 ± 1.2	5.2 ± 1.4	0.001
12 hours	3.1 ± 1.0	4.8 ± 1.3	0.002
24 hours	2.4 ± 0.9	3.9 ± 1.2	0.005
48 hours	1.6 ± 0.8	2.5 ± 1.1	0.01

Table 2: Operative and Recovery Outcomes

Outcome	Low-Pressure Group (10mmHg)	Standard-Pressure Group (14mmHg)	p-value
Mean Operative Time (minutes)	55 ± 10	60 ± 12	0.08
Intraoperative Complications	2%	3%	0.65
Length of Hospital Stay (days)	2.1 ± 0.3	2.3 ± 0.4	0.06

Discussion:

This study demonstrates that low-pressure pneumoperitoneum (10mmHg CO_2) significantly reduces post-operative shoulder tip pain compared to standard-pressure pneumoperitoneum (14mmHg CO_2), as evidenced by lower VAS scores at 6, 12, 24, and 48 hours post-operatively (13,14). These findings align with previous research suggesting that diaphragmatic irritation from CO_2 insufflation is a major contributor to post-operative pain, particularly shoulder tip pain (15).

In this study, there was no significant difference in operative time, intra-operative complications, or length of hospital stay between the two groups, indicating that low-pressure pneumoperitoneum does not compromise surgical efficiency or safety (9,12). Several earlier studies have reported similar results, confirming that reducing insufflation pressure can decrease pain without prolonging surgery or increasing the risk of complications (7,9).

The exact mechanism of shoulder tip pain is thought to be related to the phrenic nerve's sensitivity to the pressure exerted by the CO_2 trapped under the diaphragm (2,4). By lowering the insufflation pressure, the volume of gas retained postoperatively is reduced, thus decreasing the likelihood of nerve irritation and referred pain (5,14).

Conclusion:

Low-pressure pneumoperitoneum (10mmHg CO_2) is an effective method for reducing post-operative shoulder tip pain following laparoscopic cholecystectomy. This study showed that patients in the low-pressure group experienced significantly less pain without compromising surgical outcomes such as operative time and complication rates. These findings suggest that low-pressure pneumoperitoneum can be safely implemented to enhance patient comfort and recovery in laparoscopic surgery.

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