

# Laparoscopic Cholecystectomy: Low Pressure Versus Standard Pressure Pneumoperitoneum

Vijay Kumar,<sup>1\*</sup> Zahid Mehmood,<sup>1</sup> Fizza Khalid,<sup>1</sup> Manzoor Ahmed,<sup>1</sup>  
Saad Abdul Razzak<sup>1</sup>

## ABSTRACT

**Objective** To compare the postoperative outcome of low pressure pneumoperitoneum versus standard pressure pneumoperitoneum among patients undergoing laparoscopic cholecystectomy (LC).

**Study design** Comparative study.

**Place & Duration of study** Department of General Surgery ward 25, Jinnah Postgraduate Medical Center (JPMC) Karachi, from June 2019 to November 2020.

**Methodology** A total of 168 patients who underwent laparoscopic cholecystectomy were included in this study after ethical committee approval. Patients were divided into 2 equal groups of 84 each by lottery method. Group 1 patients underwent laparoscopic cholecystectomy using standard pressure pneumoperitoneum (12-18 mmHg) while group 2 patients underwent laparoscopic cholecystectomy using low pressure pneumoperitoneum (8-12 mmHg). The operative time was compared between the two groups and postoperatively all the patients were observed for shoulder tip pain and vomiting. Frequency and intensity of postoperative shoulder tip pain was assessed at 4,8,12 and 24 hours using visual analogue score.

**Results** Twenty-two (26.19%) patients complaint of shoulder pain who underwent LC at standard pressure while it was 8.33% in low pressure group that was statistically significant ( $p=0.005$ ). The mean postoperative pain score as per visual analogue score was  $1.42 \pm 1.68$  in group 1 it was  $0.92 \pm 1.07$  in group 2. The difference between the two groups was again statistically significant ( $p=0.023$ ). The frequency of vomiting was 11.90% in Group 1 and 8.33% in Group 2. The difference being statistically insignificant ( $p=0.443$ ).

**Conclusions** Low pressure pneumoperitoneum was better than standard pressure pneumoperitoneum in patients undergoing laparoscopic cholecystectomy in terms of frequency and intensity of shoulder tip pain. However, there was no difference between the two groups in terms of frequency of postoperative vomiting.

**Key words** Laparoscopic cholecystectomy, Standard pressure pneumoperitoneum, Low pressure pneumoperitoneum, Gallstone.

Department of General Surgery JPMC Karachi

## Correspondence:

Dr. Vijay Kumar<sup>1\*</sup>

Department of General Surgery (Ward 25)  
Jinnah Postgraduate Medical Center  
Karachi

E mail. drvijaybmc@gmail.com

## INTRODUCTION:

Gallstone disease constitutes a major public health problem affecting about 10-20% of the adult population of the world with a female preponderance.<sup>1</sup> The prevalence of cholelithiasis is 10.4% in a study from Pakistan.<sup>2</sup> The advent of minimally invasive laparoscopic cholecystectomy in 1989 increased the number of patients undergoing this procedure. It is a procedure of choice in benign gallbladder diseases

because of reduced hospital stay, early mobility, early return to work and better cosmesis.<sup>3</sup>

In laparoscopic cholecystectomy, a good working and viewing field is obtained with the help of pneumoperitoneum created by the insufflation of carbon dioxide (CO<sub>2</sub>) gas.<sup>4</sup> This is one of the main end products of cellular metabolic pathway.<sup>5</sup> The cause of pain and vomiting is irritation of the diaphragm and increased stretching of the peritoneum which is caused by the high pressure and excessive absorption of CO<sub>2</sub> from the peritoneal cavity.<sup>6</sup>

A study showed that 7.5% patients complained of pain at shoulder tip in low pressure laparoscopic cholecystectomy versus 23.8% in standard pressure group.<sup>4</sup> Another study reported that the frequency of postoperative vomiting in patients in first 24 hours was not statistically significant.<sup>6</sup> The duration of surgery was more in low pressure group versus standard pressure group however the frequency of shoulder pain was significantly less.<sup>7</sup> However, another study noted that an increased number of patients reported postoperative shoulder pain in the low pressure group. Similarly, the difference in operative time between the two groups of patients was insignificant.<sup>8</sup> Sandhu et al reported no significant difference between the two groups in terms of operation time, frequency of shoulder tip pain and intensity of pain ( $p=0.07$ ).<sup>9</sup> There are limited number of studies regarding the outcome of insufflation pressures of pneumoperitoneum in laparoscopic cholecystectomy. Previous studies comparing the two techniques in International literature have also reported conflicting results. The rationale of the current study was to compare low pressure pneumoperitoneum with standard pressure pneumoperitoneum to find out which technique was better to minimize postoperative complications.

#### METHODOLOGY:

This was a comparative study conducted at the Department of General Surgery, Jinnah Postgraduate Medical Center Karachi, from June 2019 to November 2020. A total of 168 patients who underwent laparoscopic cholecystectomy were included in this study after ethical committee approval. Sample size was calculated using WHO sample size calculator.

After taking written and informed consent patients were randomly divided into two equal groups of 84 patients each by lottery method. Group 1 patients underwent laparoscopic cholecystectomy using standard pressure pneumoperitoneum (12-18 mmHg) while group 2 patients underwent laparoscopic

cholecystectomy using low pressure pneumoperitoneum (8-12 mmHg).

Patients were admitted through outpatient department. Patients between 20 to 60 years of age, both gender, BMI/m<sup>2</sup> between 20 to 35, ASA Class I, and II, undergoing elective laparoscopic cholecystectomy were included in this study. Patients with bleeding disorders, ischemic heart disease, hypertension, diabetes mellitus and drug abuser were excluded from this study. The operative time was compared between the two groups and postoperatively patients were observed for shoulder tip pain and vomiting in first 24 hours. Frequency and intensity of postoperative shoulder tip pain was assessed at 4,8,12 and 24 hours using visual analogue score for pain. Data in both the groups were recorded on a predesigned form and analyzed by SPSS version 23.0. Chi square test was applied and a p-value of <0.05 was considered as significant.

#### RESULTS:

A total of 168 patients were included. The mean age of patients was  $41.54 \pm 9.33$  year. The mean age of patients in group 1 was  $42.18 \pm 9.19$  year and in group 2  $41.50 \pm 9.51$  year. The age distribution of the patients in both groups was statistically insignificant ( $p=0.639$ ). Majority of the patients ( $n=90 - 53.57\%$ ) were between 41 to 60 years of age. In this study patients ( $n=116 - 69.64\%$ ) were females. The gender distribution between the two groups was statistically insignificant ( $p=0.401$ ). Most of the patients ( $n=71 - 42.3\%$ ) included in the study belonged to ASA class II. The difference between the groups was insignificant ( $p=0.922$ ). The mean BMI was  $27.35 \pm 3.11$  Kg/m<sup>2</sup> in group 1 while it was  $26.52 \pm 2.99$  Kg/m<sup>2</sup> in group 2. This was statistically insignificant ( $p=0.083$ ). Most of the patients 88 ( $n=88 - 52.4\%$ ) had BMI between 26-30 Kg/m<sup>2</sup>.

The mean operative time was  $32.58 \pm 5.3$  minutes in standard pressure pneumoperitoneum group 1 while it was  $34.73 \pm 8.14$  minutes in the low pressure pneumoperitoneum group 2 respectively and that was statistically significant ( $p=0.045$ ). The mean postoperative pain score was  $1.42 \pm 1.68$  in group 1 while it was  $0.92 \pm 1.07$  in group 2. The difference was again statistically significant ( $p=0.023$ ). The overall frequency of vomiting in this study was 17 (10.12%). The frequency of vomiting was 19 (11.90%) in group 1 and 14 (8.33%) in group 2, the difference being statistically insignificant ( $p=0.443$ ). The overall frequency of shoulder pain in the study was 29 (17.86%). The frequency of shoulder pain was 43 (26.19%) in group A while it was 14 (8.33%)

**Table I: Comparison of Frequency of Shoulder Pain**

Shoulder Pain	Group 1(n=84)		Group 2 (n=84)		Total (n=168)	
	No. of patients	%	No. of patients	%	No. of patients	%
Yes	22	26.19	8	9.52	30	17.86
No	62	73.81	76	90.48	138	82.14

in group B, the difference was statistically significant ( $p=0.005$ ). The distribution of patients according to frequency of shoulder tip pain is shown in table I.

#### DISCUSSION:

Laparoscopic cholecystectomy is the most commonly performed surgery worldwide.<sup>10</sup> Although laparoscopic surgery has many advantages there are number of adverse events and complications associated with the procedure.<sup>11</sup> Insufflation of pneumoperitoneum is necessary for creation of a working and viewing field inside the abdominal cavity. The stretch of peritoneum and diaphragm results in postoperative shoulder pain, nausea and vomiting.<sup>12</sup> Different pneumoperitoneal pressures have been tried by surgeons across the globe with varied success.

The mean age of patients in this study was  $41.84 \pm 9.32$  years, which is almost similar to others.<sup>4,7,13</sup> In this study female preponderance was noted which is similar to many others in literature though some had reported even higher female frequency.<sup>4,8,9</sup> The mean operative time was  $32.58 \pm 5.3$  minutes in standard pressure group which was shorter than the low pressure group and was statistically significant. However, other studies did not find any difference in operative time.<sup>4,7-9</sup>

The mean postoperative pain score was more in group 1 and the difference between the two groups was statistically significant. The frequency of shoulder pain was more in standard pressure group and the difference was statistically significant. Vijayaraghavan et al also reported the intensity of pain on VAS was less in low pressure versus standard pressure laparoscopic cholecystectomy group.<sup>14</sup> Same were the observations in other studies.<sup>4,15</sup> However, Chok et al reported that the difference between the two groups in terms of frequency of shoulder tip pain was not significant.<sup>16</sup>

The frequency of vomiting was also more in group 1 but it was not significant. Nasajiyani et al also reported that the difference in frequency of nausea and vomiting between the two groups was not significant.<sup>7</sup> Another study reported that frequency of vomiting did not show any statistical difference

between the groups.<sup>17</sup> Thus the results of this study were comparable to the findings of the national and international literature. The low pressure pneumoperitoneum technique had slight edge over the standard pressure group, however the selection of the patients should be done meticulously.

#### CONCLUSIONS:

Low pressure pneumoperitoneum technique produced less frequency and intensity of pain at shoulder tip. However, there was no significant difference in terms of frequency of postoperative vomiting.

#### REFERENCES:

1. Stinton LM, Shaffer EA. Epidemiology of gallbladder disease: cholelithiasis and cancer. *Gut Liver*. 2012;6:172-87.
2. Bilal M, Haseeb A, Saad M, Ahsan M, Raza M, Ahmed A, et al. The prevalence and risk factors of gallstone among adults in Karachi, South Pakistan: A Population based study. *Glob J Health Sci*. 2016;9:106-14.
3. Coccolini F, Catena F, Pisano M, Gheza F, Faggioli S, Di Saverio S, et al. Open versus laparoscopic cholecystectomy in acute cholecystitis. Systematic review and meta-analysis. *Int J Surg*. 2015;18:196-204.
4. Ali IS, Shah MF, Faraz A, Khan M. Effect of intra-abdominal pressure on post-laparoscopic cholecystectomy shoulder tippain: A randomized control trial. *J Pak Med Assoc*. 2016;66:S45-S9.
5. Yu T, Cheng Y, Wang X, Tu B, Cheng N, Gong J, et al. Gases for establishing pneumoperitoneum during laparoscopic abdominal surgery. *Cochrane Database Syst Rev*. 2017;6:CD009569.
6. Matsuzaki S, Jardon K, Maleysson E, D'Arpiany F, Canis M, Botchorishvili R Impact of intraperitoneal pressure of a CO2 pneumoperitoneum on the surgical peritoneal environment. *Hum Reprod*. 2012;27:1613-23.

7. Nasajiyani N, Javaherfouroush F, Ghomeishi A, Akhondzadeh R, Pazyar F, Hamoonpou N. Comparison of low and standard pressure gas injection at abdominal cavity on postoperative nausea and vomiting in laparoscopic cholecystectomy. *Pak J Med Sci.* 2014;30:1083-7.
8. Dey A, Malik VK. Shoulder tip pain following laparoscopic cholecystectomy-A randomized control study to determine the cause. *Indian J Surg.* 2015;77:381-4.
9. Sandhu T, Yamada S, Ariyakachon V, Chakrabandhu T, Chongruksut W, Ko-iam W. Low-pressure pneumoperitoneum versus standard pneumoperitoneum in laparoscopic cholecystectomy, a prospective randomized clinical trial. *Surg Endosc.* 2009;23:1044-7.
10. Taki-Eldin A, Badawy AE. Outcome of laparoscopic cholecystectomy in patients with gallstone disease at a secondary level care hospital. *Arq Bras Cir Dig.* 2018;31:e13478.
11. Gul R, Dar RA, Sheikh RA, Salroo NA, Matoo AR, Wani SH. Comparison of early and delayed laparoscopic cholecystectomy for acute cholecystitis: experience from a single center. *N Am J 12. Med Sci.* 2013; 5: 414-8.
12. Sabzi Sarvestani A, Zamiri M. Residual pneumoperitoneum volume and postlaparoscopic cholecystectomy pain. *Anesth Pain Med.* 2014;4(4):e17366.
13. Ghosh B, Gangopadhyay A. Prospective randomised trial of standard pressure versus low pressure laparoscopic cholecystectomy in a tertiary care hospital from Kolkata: Our experience. *Asian J Med Sci.* 2018;9:17-22.
14. Vijayaraghavan N, Sistla SC, Kundra P, Ananthanarayan PH, Karthikeyan VS, Ali SM, et al. Comparison of standard-pressure and low-pressure pneumoperitoneum in laparoscopic cholecystectomy: a double blinded randomized controlled study. *Surg Laparosc Endosc Percutan Tech.* 2014;24:127-33.
15. Yasir M, Mehta KS, Banday VH, Aiman A, Masood I, Iqbal B. Evaluation of postoperative shoulder tip pain in low pressure versus standard pressure pneumoperitoneum during laparoscopic cholecystectomy. *Surgeon.* 2012;10:71-4.
16. Chok KS, Yuen WK, Lau H, Fan ST. Prospective randomized trial on low-pressure versus standard-pressure pneumoperitoneum in outpatient laparoscopic cholecystectomy. *Surg Laparosc Endosc Percutan Tech.* 2006;16:383-6.
17. Nematihonar B, Fahimihanzaei H, Kamranmanesh M, Memary E, Shahbazi A, Mirkheshti A. Comparison postoperative shoulder pain, nausea, and vomiting between low and normal pressure pneumoperitoneum in laparoscopic cholecystectomy. *Ann Anesth Crit Care.* 2017;2:e14917.

Received for publication: 13-02-2021

Accepted after revision: 10-07-2021

Ethical statement: Informed consent was taken from the patients.

Author's Contributions:

Vijay Kumar: Concept, literature review, data collection, manuscript writing and final approval.

Zahid Mehmood: Data collection, manuscript writing and final approval.

Fizza Khalid: Data collection and literature review.

Manzoor Ahmed: Data collection and literature review.

Saad Abdul Razzak: Data collection and literature review.

Competing Interest:

The authors declare that they have no competing interest.

Source of Funding: None

How to cite this article:

Kumar V, Mehmood Z, Khalid F, Ahmed M, Razzak SA. Laparoscopic cholecystectomy: Low pressure versus standard pressure pneumoperitoneum. *J Surg Pakistan.* 2021;26 (2):56-9. Doi:10.21699/jsp.26.2.4.