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## **To evaluate post-operative shoulder tip pain in low pressure (10MMHG Co2) versus standard pressure (14MMHG Co2) pneumoperitoneum in laparoscopic cholecystectomy: A one year randomized controlled trial hospital-based study**

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**Abstract**---Background: Nowadays, the gold standard of care for cholelithiasis is laparoscopic cholecystectomy (LC). After a LC, post-operative shoulder tip pain is a typical complaint. The main cause of this shoulder tip pain is pneumoperitoneum caused by carbon dioxide. The present study was undertaken to evaluate the post-operative shoulder tip pain in low pressure (10MMHG Co2) versus standard pressure (14MMHG Co2) pneumoperitoneum in LC. Method: A prospective randomized controlled trial incorporating 70 patients with symptomatic uncomplicated cholelithiasis who underwent LC using a four-port technique. Patients were divided randomly in two groups: 35 patients underwent Low Pressure LC (10MMHG Co2) (Group-A), and another 35 patients underwent Standard Pressure LC (14MMHG Co2) (Group-B). Postoperative shoulder tip pain was assessed at 4, 8 and 24 h after operation by the Visual Analogue Scale (VAS) of Pain. Results: 11 patients (31.42%) in group B complained of post-operative shoulder tip pain as compared to only 4 patients (11.42%) in group A which was statistically significant, (P=0.0414). The mean intensity of post-operative shoulder tip pain assessed by

VAS scale at 4, 8 and 24 h was less in group A as compared to group B, although statistical significance was seen at all time intervals with p-value of 0.047, 0.037 and 0.005 respectively. Total analgesic requirements and mean length of post-operative hospital stay were less in group A as compared to group B. Conclusion: The LC in low-pressure pneumoperitoneum at 10 mm of hg pressure is better than standard pressure (14mm hg Co2) pneumoperitoneum as it results in significant reduction in frequency and intensity of postoperative shoulder tip pain, and it decreases the postoperative analgesics requirement and duration of hospital stay.

**Keywords**---laparoscopic cholecystectomy, cholelithiasis, shoulder tip pain, pneumoperitoneum, carbon dioxide, visual analogue scale.

## **Introduction**

Laparoscopic cholecystectomy is gold standard technique for cholelithiasis nowadays. After laparoscopic cholecystectomy many patients complain of significant shoulder tip pain which prolongs the hospital stay of the patient [1]. Laparoscopic cholecystectomy can be performed using low-pressure in approximately 90% of people [2]. In some studies, it is shown that low-pressure pneumoperitoneum (less than 10 mmHg) is a feasible and safe technique and results in decreased postoperative pain and nearly the same operative time compared with standard pressure pneumoperitoneum (12 to 16mmHg) [3]. As there are some different conclusions about the benefits of low-pressure pneumoperitoneum than the standard-pressure in laparoscopic cholecystectomy surgeries. Hence the present study was planned to compare postoperative shoulder pain in low pressure (10MMHG Co2) versus standard pressure (14MMHG Co2) pneumoperitoneum in laparoscopic cholecystectomy.

## **Materials and Methods**

After obtaining Institutional Ethical Committee approval and written informed consent from all the patients, this randomized controlled trial hospital-based study was conducted in the Department of General Surgery at Tertiary Care Centre during a period of 1 year from December 2021 to December 2022. A total 70 patients of either sex, ASA classes I, II and III, age between 18-75 years with uncomplicated symptomatic cholelithiasis underwent elective laparoscopic cholecystectomy were included in the study. They were randomly divided into 2 groups of 35 in each group. Group A patients underwent laparoscopic cholecystectomy with low pressure pneumoperitoneum (10 mmHg Co2) while group B underwent laparoscopic cholecystectomy with standard pressure pneumoperitoneum (14 mmHg Co2). Patients with acute inflammation or any other complication of gall stone disease, choledocholithiasis, co-existent liver disease, any intraoperative or postoperative complication such as bile duct injury, bile duct obstruction, infection and high fever, diseases like hypertension, coronary artery diseases, diabetes mellitus, COPD, asthma, conversion to open cholecystectomy and pregnant women were excluded from the study.

Postoperative shoulder tip pain was assessed at 4, 8 and 24 h after operation by the Visual Analogue Scale of Pain (V.A.S.). The pain scale, with scores ranging from 0 (no pain) to 10 (agonizing pain) was used, allowing patients to mark a point along the scale that best represented their shoulder tip pain at that time. Patients were aware that the scale served to analyse the presence and intensity of shoulder tip pain alone and was not a representation of generalized postoperative discomfort. Analgesic requirements of all the patients in the postoperative period and length of hospital stay were also recorded.

### Statistical Analysis

The data were collected and entered in Microsoft Excel sheet and then statistically analysed using SPSS Version 20.0. Continuous variables were expressed as mean  $\pm$  SD and this data were compared in both research groups' using One-Way ANOVA. The categorical variables were summarized as frequencies and percentages and this data compared in both research groups' using chi-square test. A P-value of  $<0.05$  considered statistically significant.

### Observations and Results

A total of 70 patients underwent elective surgery for gall stone disease were enrolled and randomly divided into two groups (35 in each group). Both the groups were comparable and found no significant difference with respect to demographic profile of the patients, ( $p>0.05$ ) as shown in table 1.

Table 1: Demographic profile of the study groups

Demographic data	Group A	Group B	P value
Mean age in years	45.5 $\pm$ 7.9	46.2 $\pm$ 8.7	0.726
Gender (Male/female)	15/20	13/22	0.625
Mean BMI (kg/m <sup>2</sup> )	26.8 $\pm$ 4.5	26.6 $\pm$ 4.3	0.850
ASA (I: II: III)	19:9:7	12:13:10	0.242
Duration of surgery (min)	33.2 $\pm$ 7.4	32.7 $\pm$ 6.83	0.769

Out of 35, 11 patients (31.42%) in group B complained of post-operative shoulder tip pain as compared to only 4 patients (11.42%) in group A. The results were statistically significant with P value 0.0414, (Figure 1).

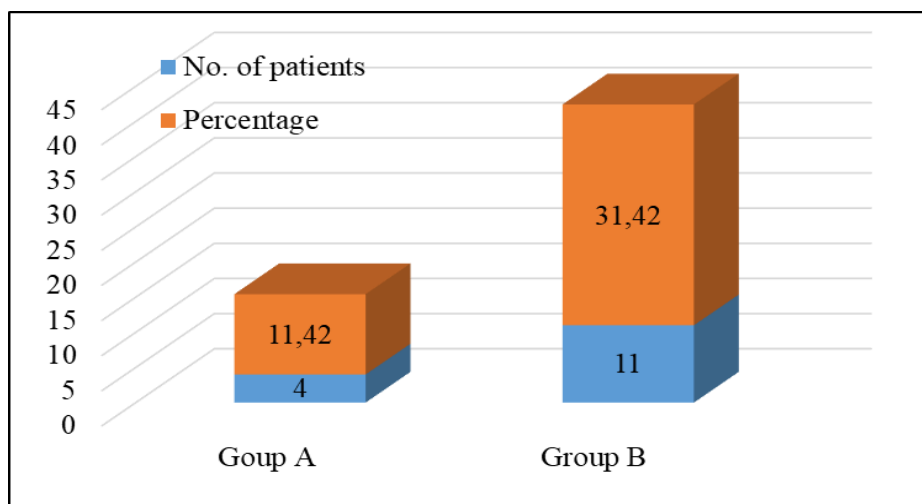


Figure 1: No. of patients with post-operative shoulder tip pain in each group.

The rate of shoulder-tip pain was matched between the groups at 4,8 and 24 h after the surgery using One-Way ANOVA. The results determined that there were significant differences between the two groups in all time intervals sets with p-value of 0.047, 0.037 and 0.005 respectively (Table 2).

Table 2: Mean scores of post-operative shoulder tip pain on VAS score

Time after surgery	Group A	Group B	P value
4 hours	4.2±0.44	4.43±0.51	0.047*
8 hours	2.8±1.2	3.5±1.53	0.037*
24 hours	0.2±0.43	0.63±0.76	0.005*

Post-operative analgesics requirement and post-operative hospital stay was significantly less in low pressure group (group A) as compared to Standard pressure group (Group B), (Table 3).

Table 3: Analgesic requirements and length of hospital stay

Analgesic required	Group A	Group B	P value
Yes	19 (54.28%)	25 (71.42%)	0.137
No	16 (45.71%)	10 (28.57%)	
Total analgesic requirement	1.15±0.66	1.68±0.78	0.003*
Mean hospital stay (days)	1.43±0.82	1.59±0.67	0.375

## Discussion

The present study showed that shoulder pain significantly decreased following laparoscopic cholecystectomy by low-pressure pneumoperitoneum (10MMHG Co2) than laparoscopic cholecystectomy under the standard-pressure pneumoperitoneum (14MMHG Co2). This finding is comparable with the previous studies [4-9]. However, the results of this study demonstrate the effectiveness of

low-pressure pneumoperitoneum created during LC in reducing both frequency and severity of shoulder tip pain. The frequency of shoulder tip pain after standard pressure LC was significantly higher as compared to low pressure LC. Out of 35 patients, 11 (31.42%) complained of shoulder tip pain after standard pressure LC as compared to 4 patients (11.42%) in low pressure LC. Thus, the incidence of shoulder tip pain was 2.7 times lower after low pressure LC than standard pressure LC ( $p < 0.05$ ). These results are consistent with the findings of Yasir M et al [9] and Barczynski M et al [10]. Also, the studies conducted by Sarli L et al [11], Faisal Bilal Lodhi et al [12] and Sandhu T et al [13] demonstrated similar results.

In the current study, the mean intensity of post operative shoulder tip pain at 4 h, 8 h and 24 h was higher after standard pressure LC as compared to low pressure LC. The mean intensity of post operative shoulder tip pain at 4 h was  $4.2 \pm 0.44$  in low pressure LC and  $4.43 \pm 0.51$  in standard pressure LC. The mean intensity of post operative shoulder tip pain at 8 h was  $2.8 \pm 1.2$  in low pressure LC and  $3.5 \pm 1.53$  in standard pressure LC. However, the mean intensity of post operative shoulder tip pain at 24 h was  $0.2 \pm 0.43$  in low pressure LC and  $0.63 \pm 0.76$  in standard pressure LC. These results determined that there were significant differences between the two groups in all time intervals sets with p-value of 0.047, 0.037 and 0.005 respectively. Similar findings are reported in studies done by Kassem M et al [7], Agarwal L et al [8] and Yasir M et al [9].

Although the analgesic requirements for shoulder tip pain were less in low pressure LC as compared to standard pressure LC. The mean number of analgesic injections was  $1.15 \pm 0.66$  in low pressure LC and  $1.68 \pm 0.78$  in standard pressure LC which was statistically significant ( $p = 0.003$ ). The postoperative hospital stay was less in low pressure LC group ( $1.43 \pm 0.82$  days) as compared to standard pressure LC group ( $1.59 \pm 0.67$  days). However, these differences between the two groups did not reach statistical significance ( $p = 0.375$ ). These results are in argument with the results of Agarwal L et al [8] and Yasir M et al [9].

Due to a decrease in the effective working space in low pressure pneumoperitoneum, the major concern of low intra-abdominal pressure would have been the operative time and conversion to open surgery. In present study, the operative time in the two groups were comparable statistically, although the mean operative time in group B was less than group A. There were no conversions to open surgery in either group. This study is a single institute-based study with small sample size. So, multicentric study with larger study group is needed. Moreover, detailed studies on physiological, biochemical, and metabolic effect of low-pressure pneumoperitoneum are also needed.

## **Conclusion**

The laparoscopic cholecystectomy in low-pressure pneumoperitoneum at 10 mm of hg pressure is better than standard pressure (14mm hg Co2) pneumoperitoneum as it results in significant reduction in both the frequency and intensity of postoperative shoulder tip pain and it decreases the demand for postoperative analgesics, reduces the duration of hospital stay and hence improves the quality of life in the early stage of postoperative rehabilitation. Based

on these results, the use of low-pressure pneumoperitoneum during laparoscopic cholecystectomy is recommended as it has fewer side effects over standard pressure pneumoperitoneum.

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