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Research Article

IMPACT OF LOW PRESSURE (10mmHg) vs STANDARD PRESSURE (14mmHg) PNEUMOPERITONEUM ON SHOULDER TIP PAIN AFTER LAPAROSCOPIC PROCEDURE IN TERITIARY CARE CENTRE: A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Background: Shoulder pain is a common complaint following laparoscopic surgery. There was no difference in visualisation of pelvis while shoulder pain was significantly less in LPCP. The beneficial impact of standard pressure and LPCP during laparoscopic surgeries needs to be evaluated in light of patient's safety and surgeons" satisfaction.
Objective: To compare frequency and intensity of post operative shoulder tip pain in low pressure (10mmHg) vs standard pressure (14 mmHg) pneumoperitoneum laparoscopic procedure.
Materials and Methodology: The present study was prospective observational conducted at Department of Surgery of Tertiary care teaching hospital during 1st JUNE 2023 to 30th April 2025. A sample size of 100 patients both male and female and age group 18 to 60 years that underwent elective Laparoscopic procedure during study period was included in the study. The patients were divided into two groups Group 1 (SPLC) and Group 2 (LPLC) with 50 patients each. In the current study, the pneumoperitoneum with PaCO2 of 7–10 and 12–14 mmHg was used in the first and second groups, respectively. All statistical analysis was performed by using SPSS ver. 22. and Microsoft Excel 2019.
Results: The incidence of shoulder pain was significantly less in LPLC group (24%) than SPLC group (6%) (P=0.031) The scores in both groups show a comparable level of difficulty for the two techniques and the difference was not statistically significant (P =0.581). Among the both groups, the postoperative hospital stay in LPLC group was found to be significantly lesser than SPLC group (P <0.05).
Conclusion: The present study concludes that laparoscopic surgery in low pressure pneumoperitoneum at 7-10 mm of hg pressure is safe and feasible in the hand of experienced surgeon.

Keywords*: Low Pressure Pneumoperitoneum, laparoscopic surgery, Shoulder tip pain.*

INTRODUCTION

Shoulder pain is a common complaint following laparoscopic surgery.[1,2] The incidence varies, but is common, being experienced in approximately one third of patients following laparoscopic surgeries.[3,4] The pain usually lasts 2 to 3 days and is relieved by simple analgesics such as paracetamol and codeine.[5,6]

Standard intra-peritoneal pressure has been associated with adverse cardiac, pulmonary and renal effects and with also increased incidence of shoulder tip pain (STP) [7] 20% to 80% patients following laparoscopic cholecystectomy suffer from STP. [8] Peritoneal stretching and diaphragmatic irritation by CO2 and imitative carbonic acid fronted after mixing

with peritoneal fuses lead to STP Collins KM, 1984, however, emphasized diaphragmatic irritation due to CO2 pneumoperitoneum as a frequent cause of shoulder tip pain.[9]

Many prospective observational study have shown the promising results of different manoeuvres like low pressure CO2 pneumoperitoneum (LPCP) at the range of 8-10 mmHg, low insufflation flow, use of drains, abdominal wall lift (AWL), active gas aspiration, low insufflation flow, N2O pneumoperitoneum, intraperitoneal instillation of bupivacaine, pulmonary recruitment manoeuvre (PRM) and intraperitoneal normal saline infusion (INSI) in significant reduction of incidence and severity of STP prospective observational study suggest a beneficial role of LPCP in reducing shoulder pain.[10] However, in spite of such promising outcome, LPCP is not widely adopted during routine LC. [11]

There was no difference in visualisation of pelvis while shoulder pain was significantly less in LPCP hysterectomy group. The beneficial impact of standard pressure and LPCP during laparoscopic surgeries needs to be evaluated in light of patient's safety and surgeons" satisfaction. [12]

Therefore, the present research aimed to compare the impact of low pressure (10mmHg) vs standard pressure (14 mmHg) pneumoperitoneum on shoulder tip pain after laparoscopic procedure at tertiary care centre.

OBJECTIVES:

- To compare the frequency and intensity of post operative shoulder tip pain in low pressure (10mmHg) vs standard pressure (14 mmHg) pneumoperitoneum laparoscopic procedure.
- To compare surgeons' satisfaction score and length of hospital stay in the cases of low pressure(10mmHg) vs standard pressure (14 mmHg) pneumoperitoneum.

MATERIALS AND METHODOLOGY

The present study was prospective observational conducted at Department of Surgery of Tertiary care teaching hospital during 1st JUNE 2023 to 30th April 2025. A sample size of 100 patients both male and female and age group 18 to 60 years that underwent elective Laparoscopic procedure during study period was included in the study. Patients with rupture of gallbladder, empyema, common bile duct stones, extensive upper abdominal surgery, pregnant females, fatty liver grade 3 and 4, elevated liver enzymes before the surgery and patients with body mass index (BMI) >30 and <19 were excluded. The study was approved by the Ethical Committee of the Institute. The patients were divided into two groups Group 1 (SPLC) and Group 2 (LPLC) with 50 patients each.

In the current study, the pneumoperitoneum with PaCO2 of 7–10 and 12–14 mmHg was used in the first and second groups, respectively. The standard four-port method, the same surgical method, and general anaesthesia was used in the two groups. The same anaesthesia protocol was used in both groups. Shoulder-tip pain was evaluated in both groups based on the verbal rating scale (VRS) within 1, 3, 6, 12, and 24 h after the surgery in a way that no pain = 0, moderate pain = 1, medium pain (need one dose of sedative) = 2, severe pain = 3, and intractable pain = 4.

All statistical analysis was performed by using SPSS ver. 22. and Microsoft Excel 2019. If applicable, for qualitative data test like 't' test and Chi-square test and was used for comparison of variables. P-value < 0.05 was considered as significant.

RESULTS

Table 1: Demographic characteristics distribution among both groups

Demographic variables		Group 1 (SPLC)	Group 2 (LPLC)	P value
Age group (years)	Mean ± SD	37.27 ±13.22	36.23 ±12.89	0.78*
Gender	Male (%)	13 (26.0)	14 (28.0)	0.61
	Female (%)	37 (74.0)	36 (72.0)	

The mean age in Group 1 (SPLC) and Group 2 (LPLC) was 37.27 ±13.22 and 36.23 ±12.89 years respectively. There was no significant difference in age distribution in both groups (P=0.78). In Group 1 (SPLC), there were 13 males (26%) and 37 females (74%), while in Group 2 (LPLC), there were 14 males (28%) and 36 females (72%) with no statistically significant difference. (Table 1)

Table 2: Comparison of incidence and intensity of postoperative shoulder pain among both groups.

Incidence of shoulder	Group 1 (SPLC)	Group 2 (LPLC)	P value

pain	12/50	3/50	0.031
Pain intensity (VRS)	**Pain Score; Mean ±SD**		
1 hour	1.83 ±0.39	1.67 ±0.57	0.104
3 hours	1.42 ±0.51	1.33 ±0.57	0.407
6 hours	0.92 ±0.51	0.67 ±0.58	0.024*
12 hours	0.58 ±0.51	0.67 ±0.58	0.411
24 hours	0.25 ±0.45	0.33 ±0.58	0.442

The above table no. 2 shows comparison of incidence and pain scores for postoperative shoulder pain among the both groups. The incidence of shoulder pain was significantly less in LPLC group (24%) than SPLC group (6%) (P=0.031) and the mean postoperative pain scores showed a decrease from 1 hour to 24 hours after surgery in both the groups.

Table 3: Comparison of duration of postoperative hospital stay and time of surgery among both groups:

Variables	Group 1 (SPLC)	Group 2 (LPLC)	P value
Duration of Hospital Stay (Days)	1.71±0.6	1.48±0.51	P=0.041
Time of surgery (in minutes)	58.23 ±7.19	59.89 ±8.23	P=0.61*

The mean time of surgery in Group 1 (SPLC) and Group 2 (LPLC) was 58.23 ±7.19 and 59.89 ±8.23 minutes respectively. There was no significant difference in time of surgery in both groups (P>0.05). Among the both groups, the postoperative hospital stay in LPLC group was found to be significantly lesser than SPLC group (P <0.05). (Table 3)

Table 4: Comparing the ease of operating surgeon to perform LPLC and SPLC

Score	LPLC	SPLC	Average	P value
5 (Very Good)	10 (20.0)	11 (22.0)	10.5 (21.0)	0.581
4 (Good)	21 (42.0)	20 (40.0)	20.5 (41.0)	
3 (Fair)	11 (22.0)	12 (24.0)	11.5 (23.0)	
2 (Poor)	5 (10.0)	5 (10.0)	5 (10.0)	
1 (Bad)	3 (06.0)	2 (04.0)	2.5 (05.0)	

The above table no. 4 shows comparison of surgeon's ease to perform surgery. The scores in both groups show a comparable level of difficulty for the two techniques and the difference was not statistically significant (P =0.581).

DISCUSSION

Low pressure technique was attempted to lower the impact of pneumoperitoneum like CO2 embolism, vaso-vagal reflex, cardiac arrhythmia, hypercarbic acidosis and minimizes haemodynamic effect of insufflation. The present prospective observational study was conducted to compare the impact of low pressure (10mmHg) vs standard pressure (14 mmHg) pneumoperitoneum on shoulder tip pain after laparoscopic procedure.

In the present study, the mean age in Group 1 (SPLC) and Group 2 (LPLC) was 37.27 ±13.22 and 36.23 ±12.89 years respectively. There was no significant difference in age and gender distribution in both groups. (p>0.05)

Similar findings observed in Arnab Mandal et al[13] study where standard pressure group had mean age of 37.27±13.57 and low-pressure group had mean age of 36.12±12.63, which was comparable. Gender also shows no statistical significant difference (p>0.05). The findings were also similar to P. Shivhare et al [14] study.

In the present study, the mean time of surgery in Group 1 (SPLC) and Group 2 (LPLC) was 58.23 ±7.19 and 59.89 ±8.23 minutes respectively. There was no significant difference in time of surgery in both groups. (p>0.05) In Arnab Mandal et

al[13] study the mean duration of surgery in low-pressure group was greater (average 2 minutes) than standard pressure group but this was not statistically significant (p=0.260). Bikash Chandra Ghosh et al[15] observed operative time was more in low pressure but it was statistically insignificant. Gohil A. et al [16] also observed LPLC group had more operative time than SPLC but the difference was not statistically significant (p = 0.1) Hua et al [10] found that slight statistical significance (weighted mean difference=2.07; p<0.001) in the mean duration of surgery. This may due to they had a larger study sample and they were doing systemic review and meta-analysis.

In the present study, comparison of VRS score for shoulder pain postoperative among both groups shows the mean VRS score in Group 1 (SPLC) and Group 2 (LPLC) decreases from 1 hour to 12 hours postoperative. There was significant decreased shoulder pain in Group 2 (LPLC) compared to Group 1 (SPLC) at 6 and 12 hours postoperatively. (p<0.05)

Arnab Mandal et al[13] observed that occurrence of shoulder tip pain, mean pain score of shoulder tip pain were greater in standard pressure group and many of them were significantly greater. Bikash Chandra Ghosh et al[15] and Mir Yasir et al [6] also observed shoulder tip pain (STP) was found to be significantly higher in Standard pressure Laparoscopic cholecystectomy (SPLC) compared to Low pressure Laparoscopic cholecystectomy (LPLC). The exact mechanism of pain related to pneumoperitoneum after laparoscopy may include diaphragmatic stretching, chemical irritation of peritoneum by carbonic acids from carbon dioxide, and sympathetic nervous system activation derived from hypercarbia and leading to amplification of local tissue inflammatory response as well as splanchnic mucosal ischemia. The incidence of right shoulder pain in high pressure pneumoperitoneum may be related to diaphragmatic distention that causes irritation at the phrenic nerve distribution area. The removal of the remaining exogenous carbon dioxide at the end of operation reduced the incidence and severity of referred shoulder pain.[17]

Laparoscopic surgery in low pressure pneumoperitoneum at 10 mm of hg pressure is safe and feasible in the hand of experienced surgeon. Intra-operative complications, operative field visualization, operative difficulties, conversion rates, duration of surgery are not affected by low-pressure pneumoperitoneum. Moreover, low-pressure pneumoperitoneum decreases consumption of intra-operative CO2, post-operative pain, shoulder tip pain due to pneumoperitoneum, need of analgesia, nausea and promotes early per oral feeding, thus reduces hospital stay. So, low pressure pneumo-peritoneum imparts significant patient advantages. This simple reduction of the pressure of pneumoperitoneum from 14 mmHg to 10 mmHg, imparts the extended benefits of laparoscopic surgery.

CONCLUSION

The present study concludes that laparoscopic surgery in low pressure pneumoperitoneum at 7-10 mm of hg pressure is safe and feasible in the hand of experienced surgeon. The intra-operative complications and duration of surgery are not affected by low-pressure pneumoperitoneum. Low-pressure pneumoperitoneum decreases consumption of intra-operative CO2, post-operative pain, shoulder tip pain due to pneumoperitoneum, need of analgesia, nausea and promotes early per oral feeding, thus reduces hospital stay. So, low pressure pneumo-peritoneum imparts significant patient advantages.

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