



EVALUATION OF POST OPERATIVE PAIN IN LOW PRESSURE VERSUS STANDARD PRESSURE PNEUMOPERITONEUM DURING LAPAROSCOPIC CHOLECYSTECTOMY

Surgery

Amandeep Singh Resident

Ramendranath Talukdar Professor

Raman Sethi Assistant Professor

Abu Nasar Assistant Professor

ABSTRACT

Postoperative pain is caused by insufflation of carbon dioxide during laparoscopic surgery. The origin of postoperative laparoscopic surgery pain is due to overstretching of the diaphragmatic muscle fibres which is caused by a high carbon dioxide pressure. We aim to study the comparison between intensity and frequency of postoperative pain in laparoscopic cholecystectomy between low and standard pressure pneumoperitoneum during laparoscopic cholecystectomy. Patients admitted for elective laparoscopic cholecystectomy in the department of surgery were enrolled in the study. The patients were randomly allotted to two groups (group A and group B). In group A (n = 50), low pressure pneumoperitoneum (8 mm Hg) and in group B (n = 50), standard pressure pneumoperitoneum (14 mm Hg) was generated during laparoscopic cholecystectomy. Postoperative pain assessment was done at 6, 12 and 24 hours after laparoscopic cholecystectomy by the Visual Analogue Scale of Pain. A significantly high number of patients (14 patients) in standard pressure pneumoperitoneum complained of postoperative pain as compared to only 5 patients in low pressure pneumoperitoneum group. The mean intensity of postoperative pain assessment was done by visual analogue scoring scale at 6, 12 and 24 hours. Postoperative pain was seen less in low pressure pneumoperitoneum patients as compared to standard pressure pneumoperitoneum patients, although statistical significance was seen only at 6 hours. There was less requirement of analgesics in low pressure pneumoperitoneum patients and the mean length of postoperative hospital stay in the hospital were also less in low pressure group. Low pressure laparoscopic cholecystectomy (LPLC) significantly decreases the intensity and frequency of postoperative pain. There is decrease in the demand of postoperative analgesics, postoperative hospital stay and improvement in the quality of life in the early stage of postoperative rehabilitation in low pressure laparoscopic cholecystectomy.

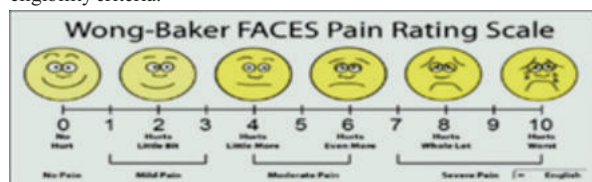
KEYWORDS

INTRODUCTION

Postoperative pain is the most common complaint after laparoscopic surgery. Initially it was recognized by gynaecologists during early experience of laparoscopic sterilization.¹ The incidence varies but is commonly experienced by patients in approximately one third of elective laparoscopic cholecystectomy patients.² Pain usually lasts for 2-3 days and can be relieved by simple analgesics such as paracetamol and codeine.³ Several causes of postoperative pain after laparoscopic cholecystectomy have been suggested which include the effect of CO₂ pneumoperitoneum, peritoneal stretching, diaphragmatic irritation, diaphragmatic injury and also shoulder abduction during surgery.^{4,5} Collins KM, 1984, however, emphasized diaphragmatic irritation due to CO₂ pneumoperitoneum as a frequent cause of postoperative pain.⁶ A number of studies have been conducted to develop methods to reduce the incidence and severity of postoperative pain following laparoscopic surgeries. Methods investigated include, low pressure insufflations,⁷ slow rate of insufflations,⁸ no CO₂ insufflation,^{9,10} use of warmed gas,¹¹ pre-emptive anti-inflammatory medication,¹² pre-emptive diaphragmatic local anaesthetic irrigation,¹³ postoperative sub-diaphragmatic suction¹⁴ and regional anaesthesia to peritoneal surfaces in the operative area.^{15,16} The present study was conducted to evaluate the postoperative pain in low pressure versus standard pressure pneumoperitoneum during laparoscopic cholecystectomy. The postoperative pain was measured on Wong-Baker FACES pain rating scale.

METHODS & MATERIALS

This study was conducted for the period from March 2021 to March 2022. Patients admitted in the department of surgery for elective cholecystectomy were enrolled in the study after fulfilling the eligibility criteria.



Criteria for inclusion

1. Elective surgery for gall stone disease.

2. Normal common bile duct (on pre-operative ultrasound).

Criteria for exclusion

1. Conversion to open cholecystectomy.
2. Acute inflammation or any other complication of gall stone disease.
3. Choledocholithiasis.
4. Co-existent liver disease.
5. Pregnancy

A total number of 100 patients were enrolled in the study (50 in each group) and were randomly allocated to one of the two groups. In group A, low pressure pneumoperitoneum (8 mm Hg) and in group B, standard pressure pneumoperitoneum (14 mm Hg) was generated during laparoscopic cholecystectomy. Postoperative pain was assessed at 6, 12 and 24 hours 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 postoperative pain at that time. Patients were aware that the scale served to analyse the presence and intensity of postoperative 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

Data were entered into a Microsoft Excel spreadsheet and translated into native SPSS (Statistical Package for Social Sciences) format. A maximum p-value of 0.05 was considered statistically significant.

RESULTS

The proportion of patients that complained of postoperative pain presenting at any time during the first 24 hours after laparoscopic cholecystectomy was lower in low pressure pneumoperitoneum group than in standard pressure group. In group A, 5 out of 50 patients complained of postoperative pain in the postoperative period while as in group B, 14 out of 50 patients complained of shoulder tip pain (Table 1).

Table 1 – Number of patients with postoperative pain in each group

Group	Group A (Low Pressure)	Group B (High Pressure)	P value
Post operative pain	5 (10%)	14(28%)	0.001

The difference between the two groups was statistically significant ($p = 0.001$). The mean intensity of postoperative pain assessed by visual analogue scoring scale at any time was less in group A as compared to group B (Table 2).

Table 2 – Mean values of postoperative pain on VAS

Time after Surgery	Group A (Low Pressure)		Group B (High Pressure)		P value
	Mean	Standard Deviation	Mean	Standard Deviation	
6 hours	4.2	0.45	4.43	1.4	0.039
12 hours	2.2	1.1	3.5	0.76	0.762
24 hours	0.2	0.45	0.64	0.74	0.068

The mean intensity of postoperative pain at 6 hours was 4.2 ± 0.45 in group A and 4.43 ± 1.4 in group B (Table 2). The mean intensity of postoperative pain at 12 hours was 2.2 ± 1.1 in group A and 3.5 ± 0.76 in group B (Table 2). The mean intensity of postoperative pain at 24 h was 0.2 ± 0.45 in group A and 0.64 ± 0.74 in group B (Table 2). Analgesic requirements for postoperative pain were less in group A as compared to group B. The mean number of analgesic injections was 2.2 ± 0.45 in group A and 2.71 ± 0.5 in group B (Table 3).

Table 3 – Use of Injectable Analgesics (Diclofenac) in patients with postoperative pain

Time after Surgery	Group A (Low Pressure) (n = 5)	Group B (High Pressure) (n = 14)
Total number of analgesics injections	11	38
Mean	2.2	2.71
Standard Deviation	0.45	0.5

The difference between the two is however statistically insignificant ($p = 0.156$). The length of postoperative stay in the hospital was 1.1 ± 0.45 and 1.21 ± 0.36 in group A and group B respectively (Table 4).

Table 4 – Length of postoperative hospital stay (days)

Group	Group A (Low Pressure) (n = 5)	Group B (High Pressure) (n = 14)
Postoperative hospital stay (Mean)	1.1	1.21
Standard Deviation	0.45	0.36

However, these differences between the two groups did not reach statistical significance ($p = 0.589$). The mean operative time in group A is 34.38 ± 5.26 min and the mean operative time in the group B is 31.52 ± 4.68 min (Table 5).

Table 5 – Distribution of mean operating time in two groups

Group A (Low Pressure)			Group B (High Pressure)		
Number of patients	Mean (minutes) X1	Standard Deviation	Number of patients	Mean (minutes) X2	Standard Deviation
50	34.38	5.31	50	31.52	4.72

The mean operative time in group A (LPLC) was more as compared to group B (SPLC), but the difference between the mean operative times of the two groups was statistically insignificant ($p = 0.396$).

Table 6 shows that 19 patients having pain had a Visual Analogue Scale scoring of 4 or more and the remaining 31 who had less pain or no pain with a scoring of 3 or less.

Table 6 - Wong-Baker FACES pain rating scale

Visual Analogue Scale Scoring	Number of patients
≤ 3	31
≥ 4	19

DISCUSSION

“The higher the pressure, the better the view” used to be the axiom invoked by surgeons who required adequate exposure for laparoscopic procedures. However, the maintenance of elevated intra-abdominal pressure for the long duration of the procedure is associated with numerous undesirable consequences including post-operative pain.

Laparoscopic cholecystectomy results in less postoperative pain and reduced analgesic consumption when compared with open cholecystectomy. Nonetheless, pain after laparoscopy might be moderate or even severe for some patients, and may require opioid treatment. The pain usually lasts for 2-3 days. The results of our study demonstrate the effectiveness of low pressure pneumoperitoneum created during laparoscopic cholecystectomy in reducing both intensity, frequency and severity of postoperative pain after laparoscopic surgery. In our study the frequency of postoperative pain after standard pressure laparoscopic cholecystectomy was significantly higher as compared to low pressure laparoscopic cholecystectomy. Out of 50 patients 14 (28%) complained of postoperative pain after standard pressure laparoscopic cholecystectomy as compared to 5 patients (10%) out of 50 in low pressure laparoscopic cholecystectomy. The incidence of postoperative pain was 2.8 times lower after low pressure laparoscopic cholecystectomy than standard pressure laparoscopic cholecystectomy ($p < 0.05$). These results are consistent with the findings of M Barczynski et al.¹⁷ In their study 8 patients (10.81%) out of 74 in the low pressure group complained of postoperative pain as compared to 18 patients (24.32%) in the standard pressure laparoscopic cholecystectomy. The postoperative pain being 2.2 times lower in low pressure as compared to standard pressure laparoscopic cholecystectomy. The studies conducted by Sarli L et al, Faisal Bilal Lodhi et al and Sandhu T et al demonstrated similar results.^{18,19} In our study the mean intensity of postoperative pain at 6 hours, 12 hours and 24 hours was higher after standard pressure laparoscopic cholecystectomy as compared to low pressure laparoscopic cholecystectomy. These results are in argument with the results of Sarli L et al, Esmat et al, and Sandhu T.²⁰ Esmat et al. (2006) concluded that postoperative pain was significantly less in low-pressure laparoscopic cholecystectomy as compared to standard pressure laparoscopic cholecystectomy. In our study, the analgesic (diclofenac) requirements for postoperative pain were less in low-pressure laparoscopic cholecystectomy as compared to standard pressure laparoscopic cholecystectomy. The difference between the two is however statistically insignificant ($p = 0.156$). In our study, the length of postoperative stay in the hospital was 1.1 ± 0.45 and 1.21 ± 0.36 in low pressure laparoscopic cholecystectomy and standard pressure laparoscopic cholecystectomy respectively. The postoperative hospital stay was less in low pressure laparoscopic cholecystectomy group. However, these differences between the two groups did not reach statistical significance ($p = 0.589$). 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 our study however 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 groups.

CONCLUSION

In accordance with earlier studies we conclude that use of simple expedient of reducing the pressure of the pneumoperitoneum to 8mm Hg results in a significant reduction in both the frequency and the severity of postoperative pain. It decreases the analgesic demand, reduces the hospital stay and hence improves the quality of life in the early stage of postoperative rehabilitation. On the basis of these results, the widespread use of low pressure pneumoperitoneum during laparoscopic cholecystectomy is recommended. However depending on safety concerns and ease of doing surgery, decision is to be taken by the operating surgeon whether to consider low pressure or high pressure pneumoperitoneum in every case to prevent further complications.

REFERENCES

- Rubinstein LM, Leberer TB, Kleinkopf V. Laparoscopic tubal sterilization: long-term postoperative follow-up. *Contraception* 1976;13:631e8.
- Leppner U, Goroshina J, Samarutel J. Postoperative pain relief after laparoscopic cholecystectomy: a randomised prospective double-blind clinical trial. *Scand J Surg* 2003;92: 121e4.
- Watt-Watson J, Chung F, Chan VW. Pain management following discharge after ambulatory sameday surgery. *J Nurs Manag* 2004;12:153e61.
- Jackson SA, Laurence AS, Hill JC. Does postlaparoscopy pain relate to residual carbon dioxide? *Anaesthesia* 1996;51:485e7.
- Kojima Y, Yokota S, Ina H. Shoulder pain after gynaecological laparoscopy caused by arm abduction. *Eur J Anaesthesiol* 2004;21:578e9.
- Collins KM, Docherty PW, Plantevin OM. Postoperative morbidity following gynaecological outpatient laparoscopy: a reappraisal of the service. *Anaesthesia* 1984;39:819e22.
- Sarli L, Costi R, Sansebastiano G, Trivelli M, Roncoroni L. Prospective randomized trial of low-pressure pneumoperitoneum for reduction of shoulder-tip pain following laparoscopy. *Br J Surg* 2000;87(9):1161e5.

8. Berberoglu M, Dilek ON, Ercan F. The effect of CO₂ insufflation rate on the post laparoscopic shoulder pain. *J Laparoendosc Adv Surg Tech A* 1998;8:273e7.
9. Koivusalo AM, Kellokumpu I. Gasless laparoscopic cholecystectomy: comparison of postoperative recovery with conventional technique. *Br J Anaesth* 1996;77:576e80.
10. Vezakis A, Davides D, Gibson JS. Randomized comparison between low-pressure laparoscopic cholecystectomy and gasless laparoscopic cholecystectomy. *Surg Endosc* 1999;13: 890e3.
11. Slim K, Bousquet J, Kwiatkowski F. Effect of CO₂ gas warming on pain after laparoscopic surgery: a randomized doubleblind controlled trial. *Surg Endosc* 1999;13:1110e4.
12. Phinchantra P, Bunyavehchevin S, Suwajanakorn S. The preemptive analgesic effect of celecoxib for day-case diagnostic laparoscopy. *J Med Assoc Thai* 2004;87:283e8.
13. Cunniffe MG, McAnena OJ, Dar MA, Callear J, Flynn N. A prospective randomized trial of intraoperative bupivacaine irrigation for management of shoulder-tip pain following laparoscopy. *Am J Surg* 1998;176(3):258e61.
14. Jorgensen JO, Gillies RB, Hunt DR. A simple and effective way to reduce postoperative pain after laparoscopic cholecystectomy. *Aust NZ J Surg* 1995;65:466e9.
15. Johnson N, Onwude JL, Player J. Pain after laparoscopy: an observational study and a randomized trial of local anesthetic. *J Gynecol Surg* 1994;10:129e38.
16. Gharaibeh KI, Al-Jaberi TM. Bupivacaine instillation into gallbladder bed after laparoscopic cholecystectomy: does it decrease shoulder pain? *J Laparoendosc Adv Surg Tech A* 2000; 10:137e41.
17. Barczynski M, Herman RM. A prospective randomized trial on comparison of low-pressure (LP) and standard-pressure (SP) pneumoperitoneum for laparoscopic cholecystectomy. *Surg Endosc* 2003;17(4):533e8.
18. Faisal Bilal Lodhi, Riaz Hussain. Laparoscopic cholecystectomy; Low-pressure pneumoperitoneum for shoulder-tip pain. *Prof Med J* 2003;10(4):266e70.
19. 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(5): 1044e7.
20. Esmat ME, Elsebae MM, Nasr MM, Elsebae SB. Combined low pressure pneumoperitoneum and intraperitoneal infusion of normal saline for reducing shoulder tip pain following laparoscopic cholecystectomy. *World J Surg* 2006;30(11):1969e73.