ORIGINAL ARTICLE

Outcome Comparison in patients Undergoing Laparoscopic Cholecystectomy Using Low Pressure and Standard Pressure Pneumoperitoneum

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ABSTRACT

Background: Laparoscopic cholecystectomy is now an established form of treatment for patients with symptomatic gall stones. Although thought to result in less postoperative pain, recent studies have shown that patients may experience considerable pain after laparoscopic cholecystectomy. Surgeons used different ways to reduce the intensity of post-operative pain. The Low Pressure Pneumoperitoneum during laparoscopic cholecystectomy proved to be very effective in this aspect.
Aim: To compare outcome in patients undergoing laparoscopic cholecystectomy using low pressure and standard pressure pneumoperitoneum.
Methods: 180 patients were selected for study and equally divided in two equal groups. Both Groups underwent Laparoscopic Cholecystectomy using Standard Pressure Pneumoperitoneum in Group A and low pressure pneumoperitoneum in Group B. Operative time (min), postoperative pain (VAS) and frequency of Shoulder Tip Pain was noted in both groups
Results: The mean age in SPLC and LPLC groups was 38.71±8.84 years and 40.41±12.50 years respectively. There were 19(21.21%) males in SPLC and 13(14.44%) in LPLC while there were 71(78.89%) females in SPLC and 77(85.56%) in LPLC. The mean operative time in SPLC and LPLC groups was 35.4±8.95 and 37.4±7.89 minutes respectively, the mean operative time in both groups was statistically same, p-value > 0.05. The mean pain on visual analogue scale in SPLC and LPLC groups was 3.46±0.74 and 2.84±0.75 respectively; the mean pain in LPLC was statistically less as compare to SPLC, p-value < 0.05. Shoulder tip pain in SPLC and LPLC was observed in 67(74.44%) and 84(93.33%) respectively, p-value < 0.05.
Conclusion: Laparoscopic cholecystectomy using low pressure pneumoperitoneum has significant advantages in terms of less Post-Operative Pain and reduced frequency of Shoulder Tip Pain.
Keywords: Laparoscopic cholecystectomy, post-operative pain, pneumoperitoneum

INTRODUCTION

Laparoscopic operative procedures have revolutionized abdominal surgery. There are several advantages of it like: a smaller and more cosmetic incision, reduced blood loss and shorter postoperative hospital stay[1] .Laparoscopic cholecystectomy is the treatment of choice for symptomatic cholelithiasis. Although there are clear benefits compared with open surgery, postoperative pain after Laparoscopic cholecystectomy remains an issue. Pain can prolong hospital stay and lead to increased morbidity[1,2]. After laparoscopic cholecystectomy patients complain more of visceral pain as a result of stretching of the intra-abdominal cavity, peritoneal inflammation and phrenic nerve irritation caused by residual carbon dioxide in the peritoneal cavity[3]. In open cholecystectomy the type of pain results mostly is parietal pain[4].

There is no general agreement on effective postoperative pain control. Different regimens have been proposed to relieve pain after laparoscopic surgery, such as non-steroidal anti-inflammatory drugs, local wound Anaesthetics, intra peritoneal Anaesthetics, intra peritoneal saline, gas drainage, heated gas, low-pressure gas and nitrous oxide pneumoperitoneum[5]. High pressure pneumo-peritoneum for laparoscopy brings certain changes in the function of organ system and causes postoperative pain, but using low pressure has significant advantages in terms of postoperative pain, number of analgesics used, preservation of pulmonary function and hospital stay[6]. Although using low pressure pneumoperitoneum for laparoscopy has many advantages in terms of postoperative outcome, but surgeons experience more difficulty in dissection of tissues[6].

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The rationale of the study was to assess the outcome of Low Pressure Pneumoperitoneum in laparoscopic cholecystectomy in order to reduce procedure related morbidity in terms of postoperative pain, shoulder tip pain and hospital stay. If found effective in large number of cases, can be promoted to be used in routine clinical practice.

MATERIALS & METHODS

This randomized control trial was conducted in Surgical Unit–II, Department of general surgery, Services Hospital Lahore during six month after the approval of synopsis. Sample size of 180 cases (90 in each group) was calculated with 95% Confidence Interval, 80% Power of test and taking mean±S.D. of outcome in terms of mean postoperative pain on VAS at 24 hours after surgery in both groups i.e., (5.2±0.8) in standard pressure pneumoperitoneum group and (4.6±0.81) in low pressure pneumoperitoneum group in patients undergoing laparoscopic cholecystectomy. Sampling technique was non probability purposive sampling. All patients above the age of 18 years both male & female with symptomatic gall stones assessed clinically, biochemically (WBC count, LFT's) & imaging (USG), who are planned to undergo laparoscopic cholecystectomy were included in the study.

Exclusion Criteria:

- Determined by history, biochemical test (WBC count, LFT's) & imaging (USG), patient with:
- Acute Cholecystitis (+ve Murphy's Sign, increased WBC count pericholecystic oedema & increased wall thickness on USG.)
- Cholangitis (fever, jaundice, pain & tenderness in RHC)
- Simultaneous CBD stones (diagnosed on USG)
- Gall stone pancreatitis (increased serum amylase)
- BMI >30
- ASA III & IV
- Patient not giving consent for induction into LPLC trial.

Data collection procedure: After approval from hospital ethical committee 180 patients fulfilling the inclusion criteria were admitted in surgical unit-II services hospital Lahore through the outpatient department. After taking informed consent and demographic history, patients were divided in two groups randomly using random number tables. Group A: Standard pressure laparoscopic cholecystectomy (SPLC) at 12-16mmHg pneumoperitoneum. Group B: Low Pressure Laparoscopic Cholecystectomy (LPLC) <12mmHg pneumoperitoneum. Single surgical team performed the procedure. Per-operatively operative time was measured in minutes from the first skin incision to skin closure. Postoperatively post-operative pain was assessed at 6, 12, 18 & 24 hours after surgery according to VAS. Non-narcotic analgesics were used 12 hourly. Shoulder tip pain was assessed 24 hours after surgery.

Data analysis: Data was collected & analyzed through SPSS version 20. Quantitative variables like age, operative time and postoperative pain were presented by calculating mean and standard deviation. Qualitative variables like gender and shoulder tip pain were presented by calculating frequency and percentage. Student t-test was used to compare the operative time and postoperative pain in both groups. Chi - Square test was used for comparison of shoulder tip pain in both groups. $P \leq 0.05$ was considered as significant.

RESULTS

The mean age in SPLC and LPLC groups was 38.71±8.84 years and 40.41±12.50 years respectively. There were 19(21.21%) males in SPLC and 13(14.44%) in LPLC while there were 71(78.89%) females in SPLC and 77(85.56%) in LPLC. The mean operative time in SPLC and LPLC groups was 35.4±8.95 and 37.4±7.89 minutes respectively, the mean operative time in both groups was statistically same, p-value >0.05. The mean pain on visual analogue scale in SPLC and LPLC groups was 3.46±0.74 and 2.84±0.75 respectively; the mean pain in LPLC was statistically less as compare to SPLC, p-value <0.05. Shoulder tip pain in SPLC and LPLC was observed in 67(74.44%) and 84(93.33%) respectively, p-value <0.05.

Table 1: Comparison of age, gender, operative time and pain in both study groups

		SPLC(n=90)	LPLC (n=90)	p-value
Age		38.71±8.84	40.41±12.50	0.345
Operative time		35.4±8.95	37.4±7.89	0.1125
Pain (VAS)		3.46±0.74	2.84±0.75	0.001
Gender	Male	19(21.21%)	13(14.44%)	0.242
	Female	71(78.89%)	77(85.56%)	
Shoulder tip pain	Yes	67(74.44%)	84(93.33%)	0.001
	No	23 (25.56%)	6 (6.67%)	

DISCUSSOIN

The advent of laparoscopic cholecystectomy is a milestone achieved in both the treatment of gallstones and in the evolution of minimal access surgery. The aim was to reduce the trauma during access and maintain appropriate exposure of the surgical field during surgery[7,8]. The creation of the pneumoperitoneum is the essential component for laparoscopic procedures. To achieve this surgeons have traditionally created a pneumoperitoneum of up to 14-15mmHg by insufflating carbon dioxide gas into the peritoneal cavity at the time of insertion of ports.

This has the desired effect of raising the abdominal wall away from the viscera giving room to visualize the gall bladder and surrounding organs, allowing manipulation of instruments and also allowing the intestine to fall away from the sub-hepatic space when the patient is positioned properly[8].

In this study a total of 180 patients were recruited after the inclusion and exclusion criteria were met to assess the outcome in terms of operative time (in minutes), post-operative pain (visual analogue score) and shoulder tip pain in patients undergoing laparoscopic cholecystectomy. Laparoscopic cholecystectomy with standard pressure pneumoperitoneum took an average of 35.4minutes with a minimum of 22 minutes and a maximum of 60 minutes. Lap. cholecystectomy with low pressure pneumoperitoneum took an average of 37.4 minutes with a minimum of 25 minutes and a maximum of 54 minutes. Low pressure laparoscopic cholecystectomy took an average 2 more minutes than standard pressure laparoscopic cholecystectomy and this difference was statistically insignificant (P value=0.1125).

The operative time of the two groups was comparable with a mean operative time difference of two minutes. The purpose of having a pneumoperitoneum was not lost when using a low pressure pneumoperitoneum. All the benefits of lifting of anterior abdominal wall and creation of a working space with retraction of the viscera were accomplished with the low pressure as well. The comparable operative time was an indirect indicator that the working environment as regards maneuverability and handling of the surgical instruments and visibility was neither compromised nor cumbersome. The same is reflected in international data which although at times favors the standard pressure group as regards operative time also reports various studies with no significant difference in the operative time[9].

The splanchnic circulation consists of the gastric, splenic, hepatic, pancreatic, small intestinal and colonic circulations arranged in parallel, and receives 25% of cardiac output. In healthy patients, increase in intra abdominal pressure from 10mmHg to 15mmHg significantly decreases the blood flow, in the stomach by 54%, the jejunum by 32%, the colon by 4%, the liver by 39%, the parietal peritoneum by 60%, and the duodenum by 11%. Splanchnic blood flow decreases along with insufflation time[10]. Flow within the splanchnic circulation is affected by local factors such as direct pressure on vessels, increases in partial pressure of CO_2, and metabolite buildup. One report found significantly decreased hepatic blood flow in 16 patients undergoing laparoscopic cholecystectomy. Others reported instances of fatal mesenteric ischemia and splanchnic vessel thrombosis after routine laparoscopic cholecystectomy[11].

The observation of hemodynamic impairment related to CO_2 pneumoperitoneum during laparoscopic surgery and postoperative mesenteric ischemia following laparoscopic procedures[12,13] have raised concern about local and systemic repercussion of intra-abdominal pressure increase and transperitoneal CO_2 absorption during laparoscopic surgery. It has been reported that high intra-abdominal pressure induces intestinal ischemia (decreased jejunal mucosal microcirculation measured by the laser Doppler technique), oxygen free radical production, and bacterial translocation toward the mesenteric lymph nodes, spleen and liver[14].

Others have shown that high intra-abdominal pressure was not followed by increase in blood lactate levels in experimental environment[15]. In this study, change in ventilation during intra-abdominal insufflation of CO_2 resulted in slight changes, clinically acceptable CO_2 and pH. Both remained unchanged, provided minute volume of ventilation was increased to maintain constant end-tidal PCO_2.

Our study evaluated the pain scores of patients from the two groups of standard and low pressure insufflations. At 04 different time intervals VAS was significantly lower in LPLC as compared to SPLC. VAS was recorded at time interval of 06, 12, 18 & 24 hours post operatively. Mean VAS in LPLC was 2.84 with minimum of 1.25 and maximum of 4.5. On the other hand in SPLC mean VAS was 3.46 with minimum of 2.0 and maximum of 4.75. The difference of VAS in LPLC & SPLC was statistically significant. (P value=0.0001).

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[13]. 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[16,17].

Gurusamy and Samraj carried out a review of various clinical trials evaluating low pressure and standard pressures and their effects on post operative recovery including postoperative shoulder tip pain. Their Cochrane Database review reported a

lower incidence of shoulder tip pain reported in the low pressure groups[17,18].

Our study also evaluated the presence or absence of postoperative shoulder tip pain as one of the variables, hypothesizing that the diaphragmatic stretch is directly proportional to the pressure used to create and maintain pneumoperitoneum. This study showed that only 6.67% of patients with low pressure pneumoperitoneum experienced shoulder tip pain as compared to 25.56% of patients who had undergone the procedure with the standard pressure. The result showed that the frequency of postoperative shoulder tip pain was much lower in the LPLC group as compared to SPLC group. Reducing shoulder tip pain is not only essential for patient comfort it also ensures adequate postoperative patient ventilation and prevents the development of pulmonary complications which leads to early mobilization short hospital stay and enhanced functional recovery.

CONCLUSION

Laparoscopic cholecystectomy has undoubtedly replaced the traditional open technique. Where we stand to reap the benefits of the minimal access procedures we are also challenged to discover the various components of this exciting technique e.g., the pneumoperitoneum. Low pressure pneumo-peritoneum imparts significant patient advantages and we advocate its usage based on our findings however a larger scale study incorporating other variables is required to fully set this low pressure technique as a gold standard.

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