Simple Pulmonary Recruitment Maneuver To Reduce Shoulder Pain After Laparoscopic Cholecystectomy

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ABSTRACT

Objective — *To determine the effectiveness of a simple pulmonary recruitment maneuver to reduce postoperative shoulder pain after laparoscopic cholecystectomy.*

Study design — *Quasi-experimental study.*

Place & Duration of study — *Department of Surgery, Dow Medical College, Ruth KM Pfau Civil Hospital Karachi, from August 2016 to August 2018.*

Methodology — *This study was conducted on 120 patients of either gender between 18 years to 60 years of age, admitted for laparoscopic cholecystectomy. Patients were divided into group A (control - n = 60) and group B (intervention - n = 60). The main outcome measure was postoperative shoulder pain assessed at 6, 12, 24 and 36 hours after laparoscopic cholecystectomy by using a visual analogue scale (VAS).*

Results — *The proportion of patients reporting shoulder pain in group B (38.3%) was significantly less than group A (68.3% -p = 0.002). The shoulder pain scores were markedly low (p<0.05) in group B than group A at 6 (2.13±1.05 compared with 3.24±1.72), 12 (4.87±0.814 compared with 6±2.35), 24 (2.35±1.26 compared with 3.44±1.8) and 36 (1±0.73 compared with 2.07±1.25) hours postoperatively. The mean VAS score of shoulder pain was significantly lower in group B than group A (2.59±0.53 versus 3.72±1.41 – p=0.000).*

Conclusion — *The simple pulmonary recruitment maneuver markedly reduced the postoperative shoulder pain after laparoscopic cholecystectomy.*

Key words — *Laparoscopic cholecystectomy, Postoperative shoulder Pain, Pulmonary recruitment maneuver.*

INTRODUCTION:

The introduction of laparoscopic cholecystectomy has significantly changed the perception of the postoperative course of patients by providing the advantage of smaller incisions, decreased risk of complications, and early recovery when compared to open cholecystectomy. Laparoscopic surgery provides better satisfaction to patients and is now widely accepted as the gold standard. In most of the centers, patients are sent home within the first 48 hours postoperatively.[1] General anesthesia is recommended for laparoscopic cholecystectomy, however it can also be performed under epidural or spinal anesthesia except in high risk cases such as patients with chronic obstructive airway disease.[2,3]

Creation of the pneumoperitoneum is one of the obligatory steps for laparoscopic surgeries and the most commonly used gas for creating pneumoperitoneum is carbon dioxide (CO_2). CO_2 is unique due to its characteristic of inhibiting combustion, and high water solubility.[4] Shoulder pain is one of the frequent postoperative complications associated with laparoscopic surgeries and is related to the creation of pneumoperitoneum with a reported

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frequency of 35-80%.[5,6] It can be mild to severe in intensity, usually manifests itself during first 48 hours and caused by irritation of phrenic nerves due to accumulation of carbon dioxide.[7] Similar symptoms have been reported in studies conducted for laparoscopic gynecological procedures and pelvic surgeries, with an important correlation between gas volumes accumulated in the supra-hepatic space and postoperative pain; and decreased requirement of analgesia following surgery after the active evacuation of residual gas.[8] Many studies have been conducted to scrutinize the techniques and modalities of reducing shoulder pain e.g. gasless laparoscopy,[9] preemptive use of gabapentinoids,[6] and irrigation of the peritoneal cavity and diaphragm with local anesthetic drugs.[10]

Recently simple pulmonary recruitment maneuver has been suggested to decrease shoulder pain by increasing the intra-peritoneal pressure and helping in the removal of residual gas at the end of surgery but its effect has not been examined on the selected group of patients undergoing laparoscopic cholecystectomy.[11] Laparoscopic cholecystectomy causes minimal tissue destruction so contributing factor to shoulder pain is mainly residual carbon dioxide in peritoneal cavity unlike as in other operations e.g. trauma by tackers in laparoscopic hernia repairs and trauma to tissues caused by laparoscopic procedures in gynecology and bariatric surgery.[11,12] If proven, this simple intraoperative maneuver can be implemented safely in general surgery to reduce postoperative shoulder pain and morbidity after laparoscopic cholecystectomy thus decreasing the discomfort to patients and need of analgesics.

METHODOLOGY:

This was a quasi-experimental study conducted at the Department of Surgery, Civil Hospital Karachi from August 2016 to August 2018. Sample size was calculated as 120 by keeping Level of significance= 5% and Power of the test= 80%. Approval for the study was obtained from the institutional review board and data was collected after taking oral informed consent from all the participants. Non-probability consecutive sampling technique was used for sampling. Patients were divided into two groups with 60 each using computer generated numbers allocation. Group A, the control group underwent the routine procedure, while Group B, the intervention group had additional pulmonary recruitment maneuver.

Patients of both genders with ASA status class I and II, between 18 years to 60 years were enrolled in this study. Patients with a history of previous injury to the shoulder joint, cervical vertebral disease, and musculoskeletal disorders were excluded from this study. Patients with complicated surgery (surgery duration more than two hours or converted to open cholecystectomy) and patients with an attack of acute cholecystitis were also excluded.

Data were collected after taking informed consent from the patients. A proforma sheet was used to collect information regarding demographic variables, American Society of Anesthesiologists (ASA) class, duration of procedure, complications during surgery, placement of drain, complaints of pain, nausea and vomiting. Visual analogue scale (VAS) was used to record pain scores at 6, 12, 24 hours after surgery and assessment was completed at 36 hours after surgery.

Laparoscopic cholecystectomies were performed using standard technique. Carbon dioxide was used as distension medium and all procedures were performed under general anesthesia. The patients were monitored during surgery and pulse rate, blood pressure, and pulse-oximetry findings were recorded. Randomization was done after completion of surgery and surgical ports were not removed. In group A, ports were left open and abdomen was allowed to decompress by passive evacuation of residual gas. In the intervention group, valve on ports were left open and two manual inflations of pressure 40cm H_2O were given by the anesthetist after keeping the patients in Trendelenburg position (30^0) and each inflation was held for 5 seconds. Standard postoperative analgesia (tramadol 50 mg four times daily) was administered to all patients.

Analysis of data was done using the pain scores over time intervals (6, 12, 24 and 36 hours). All data was analyzed using statistical software SPSS version 22 in computer. Mean ± SD was calculated for normally distributed (continuous) variable. Differences were analyzed by using an unpaired two tailed t test for continuous variables and x^2 test for qualitative variables between the two groups. Analysis of variance for repeated measures was used to analyze the pain scores at different time intervals and their interaction with intervention. P-value <0.05 was considered significant.

RESULTS:

A total of 120 patients were included. One hundred and nine (90.8%) patients were females. The mean age of the patients was 38.33±9.9 year (40.48±10.8 year in group B and 36.17±9.3 year in group A). Demographic data including age, sex and ASA class were similar in both groups (table I).

Table I: Demographic Characteristics of Patients of Control and Intervention Groups

Variables	Control Group (n=60)	Intervention Group (n=60)
Age		
(Mean±SD) in Year	36.17±9.3	40.48±10.08
Sex		
Female	54 (90%)	55 (91.7%)
Male	6 (10%)	5 (8.3%)
ASA Grade		
I	32 (53.3%)	36 (60%)
II	28 (46.7%)	24 (40%)

Table II: VAS Scores of Postoperative Shoulder Pain In Control And Intervention Groups

Time	Control Group	Intervention Group	P value
VAS at 6 hours	3.24±1.72	2.13±1.05	0.007
VAS at 12 hours	6±2.35	4.87±0.814	0.030*
VAS at 24 hours	3.44±1.8	2.35±1.26	0.013*
VAS at 36 hours	2.07±1.25	1±0.73	0.000*
Mean VAS Score	3.72±1.41	2.59±0.53	0.000*

Significant*

Overall 64 out of 120 (53.3%) patients reported shoulder pain postoperatively. Frequency of shoulder pain in intervention group (n=23 - 38.3%) was significantly less than control group (n=41 -68.3%). This was statistically significant with p= 0.002. The shoulder pain scores were significantly less (p<0.05) in the group B than group A at 6 (2.13±1.05 compared with 3.24±1.72), 12 (4.87±0.814 compared with 6±2.35), 24 (2.35±1.26 compared with 3.44±1.8) and 36 (1±0.73 compared with 2.07±1.25) hours postoperatively. Overall mean VAS score of shoulder pain in the intervention group was lower than the control group (2.59±0.53 versus 3.72±1.41 – p=0.000). Details are given in table II.

DISCUSSION:

Laparoscopic cholecystectomy can cause shoulder pain which may be transient or last for about 72 hours.[7] The intensity of shoulder pain varies from mild to severe with a reported incidence of 35% to 80%.[5,6] Sometimes, shoulder pain is more discomforting than the surgical site pain.[7] In an attempt to reduce postoperative shoulder pain various techniques have been widely studied.[10] Cho et al reported decreased incidence of shoulder pain by infusion of bupivacaine under right hemi-diaphragm. In a study by Chaichian et al, active gas aspiration after gynecological laparoscopic procedures showed reduction in severity of shoulder pain.[13] Different surgeons have used combination of irrigation with normal saline with low pressure pneumoperitoneum or low pressure pneumoperitoneum alone for reducing frequency of pain.[14-16] Pulmonary recruitment maneuver causes an increase in intraperitoneal pressure which eliminates CO_2 from peritoneal cavity which results in decreased irritation of peritoneum and phrenic nerve.[11].

Most of the methods studied are time consuming, use additional drugs or devices, have additive cost and expose the patients to a number of side effects like fluid overload with normal saline irrigation, use of drains increase the risk of surgical/drain site infection and cause pain and may prolong the duration of hospital stay. The pulmonary recruitment maneuver that was used in this study did not need any additional tool, is less time consuming, and not increase the hospital stay or required early follow-up.

In our study the proportion of patients who reported shoulder pain was significantly low in intervention group. Cho et al reported shoulder pain incidence of 44.4% with pulmonary recruitment maneuver which is comparable to our results.[11] The mean VAS

scores in our study at 6, 12, 24 and 36 hours were also significantly reduced in the intervention group including overall mean VAS score. Similar results are reported by other researchers.[17,18]

This study was done in patients undergoing laparoscopic cholecystectomy though shoulder pain is also reported after other surgeries with similar approach. However, as the mechanism of shoulder tip pain is widely accepted to be related to the amount of residual CO_2 this technique may be equally useful in other surgical procedures. No adverse respiratory or cardiovascular effects were observed during or after the maneuver and as the literature has suggested that during anesthesia 40 cm H_2O alveolar recruitment maneuver is a safe and efficient method to improve arterial oxygenation.[19,20] ASA I –II class patients can easily tolerate manual inflations of 60 cm H_2O.[11,12] Thus our intervention did not pose any risk of pneumothorax.

CONCLUSIONS:

A simple and time efficient clinical maneuver of pulmonary recruitment significantly reduced shoulder pain after laparoscopic cholecystectomy.

REFERENCES:

1. Xiong W, Li M, Wang M, Zhang S, Yang Q. The safety of laparoscopic cholecystectomy in the day surgery unit comparing with that in the inpatient unit: a systematic review and meta-analysis. Biomed Res Int. 2020;2020:1924134. doi.org/10.1155/2020/1924134

2. Sunamak O, Donmez T, Uzman S, Erdem VM, Erdem DA, Yýldýrým D, et al. Laparoscopic cholecystectomy under combined spinal/epidural anesthesia: a retrospective analysis of 112 cases in terms of per-and postoperative outcomes. Haydarpasa Numune Med J. 2018;58:5-11. doi: 10.14744/hnhj.2017.60783

3. Bayrak M, Altýntas Y. Comparing laparoscopic cholecystectomy in patients with chronic obstructive pulmonary disease under spinal anesthesia and general anesthesia. BMC Surg. 2018;18:65. doi: 10.1186/s12893-018-0396-1.

4. Movassaghi R, Peirovifar A, Aghamohammadi D, Anvari HM, Golzari SE, Kourehpaz Z. Premedication with single dose of acetazolamide for the control of referral shoulder pain after laparoscopic cholecystectomy. Anesth Pain Med. 2015;5:e29366. doi: 10.5812/aapm.29366

5. Kim JE, Kim JY, Lee HS, Seok S, Kil HK. Analgesic effect of trigger point injection and EMLA for shoulder pain in patients undergoing total laparoscopic hysterectomy: A randomized controlled study. Medicine (Baltimore). 2019;98(2):e14087. doi: 10.1097/MD.0000000000014087.

6. Nakhli MS, Kahloul M, Jebali C, Frigui W, Naija W. Effects of gabapentinoids premedication on shoulder pain and rehabilitation quality after laparoscopic cholecystectomy: pregabalin versus gabapentin. Pain Res Manag. 2018; 2018:1-6.

7. Mostafa RH, Mekki YM. Comparative evaluation of intraperitoneal bupivacaine and bupivacaine ketamine combined with lung recruitment for reducing postoperative shoulder pain in laparoscopic cholecystectomy. Egypt J Anaesth. 2018;34:159-64.

8. Hosseinzadeh F, Nasiri E, Behroozi T. Investigating the effects of drainage by hemovac drain on shoulder pain after female laparoscopic surgery and comparison with deep breathing technique: a randomized clinical trial study. Surg Endosc. 2020;34:5439-446. doi: 10.1007/s00464-019-07339-z.

9. Sao CH, Chan-Tiopianco M, Chung KC, Chen YJ, Horng HC, Lee WL, et al. Pain after laparoscopic surgery: Focus on shoulder-tip pain after gynecological laparoscopic surgery. J Chin Med Assoc. 2019;82:819-26. doi: 10.1097/JCMA.0000000000000190.

10. Choi GJ, Kang H, Baek CW, Jung YH, Kim DR. Effect of intraperitoneal local anesthetic on pain characteristics after laparoscopic cholecystectomy. World J Gastroenterol. 2015;21:13386-95.

11. Cho M, Kim CJ, Hahm TS, Lee YY, Kim TJ, Lee JW, et al. Combination of a pulmonary recruitment maneuver and intraperitoneal bupivacaine for the reduction of postoperative shoulder pain in gynecologic laparoscopy: a randomized, controlled trial. Obstet Gynecol Sci. 2020;63:187-94. doi: 10.5468/ogs.2020.63.2.187

12. Pasquier EK, Andersson E. Pulmonary recruitment maneuver reduces pain after laparoscopic bariatric surgery: a randomized controlled clinical trial. Surg Obstet Relat Dis. 2018;14:386-92.

13. Chaichian S, Moazzami B, Haghgoo A, Sheibani K. A New approach to an old concept for reducing shoulder pain caused by gynecological laparoscopy. J Reprod Infertil. 2018;19:56-60.

14. Bhattacharjee HK, Jalaludeen A, Bansal V, Krishna A, Kumar S, Subramanium R, et al. Impact of standard-pressure and low-pressure pneumoperitoneum on shoulder pain following laparoscopic cholecystectomy: a randomised controlled trial. Surg Endosc. 2017;31:1287-95. doi: 10.1007/s00464-016-5108-2.

15. 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;2:149-51.

16. Barczyn´ski M, Herman RM. Low-pressure pneumoperitoneum combined with intraperitoneal saline washout for reduction of pain after laparoscopic cholecystectomy: a prospective randomized study. Surg Endosc. 2004;18:1368-73.

17. Kiyak H, Yilmaz G, Ay N. Semi-Fowler positioning in addition to the pulmonary recruitment manoeuvre reduces shoulder pain following gynaecologic laparoscopic surgery. Wideochir Inne Tech Maloinwazyjne. 2019;14:567-74. doi: 10.5114/wiitm.2019.84384.

18. Güngördük K, Aþýcýoðlu O, Özdemir ÝA. Effect of the pulmonary recruitment maneuver on pain after laparoscopic gynecological oncologic surgery: a prospective randomized trial. J Gynecol Oncol. 2018 Nov;29:e92. doi: 10.3802/jgo.2018.29.e92.

19. Ryu K, Choi W, Shim J, Song T. The impact of a pulmonary recruitment maneuver to reduce post-laparoscopic shoulder pain: A randomized controlled trial. Eur J Obstet Gynecol Reprod Biol. 2017;208:55-60. doi: 10.1016/j.ejogrb.2016.11.014.

20. Grune J, Tabuchi A, Kuebler WM. Alveolar dynamics during mechanical ventilation in the healthy and injured lung. Intensive Care Med Exp. 2019;7S:34. doi: 10.1186/s40635-019-0226-5.

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Muhammad Faisal Ibrahim: Data collection, literature review, data interpretation and statistical analysis.
Qamaruddin Baloch: Drafting, critical revision and final approval.
Farhan Zaheer: Designed research methodology and manuscript writing.

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