Original Article

Pulmonary Recruitment Maneuver: An Effective Way to Reduce Postoperative Pain after Laparoscopic Cholecystectomy

Laparoscopic Cholecystectomy Induced Shoulder Pain

Muhammad Umar Farooq, Farooq Ahmad, Faisal Rauf and Muhammad Iqbal

ABSTRACT

Objective: To compare mean laparoscopy induced shoulder pain score with and without pulmonary recruitment maneuver in patients undergoing laparoscopic cholecystectomy.
The aim of this study is to evaluate the efficacy of pulmonary recruitment maneuver in reducing post operative pain after laparoscopic cholecystectomy.
Study Design: Randomized control trial study
Place and Duration of Study: This study was conducted at the conducted at Department of Surgery, Unit-III, Jinnah Hospital Lahore from May 2016 to June 2017.
Materials and Methods: Both males and females of age between 16-60 years were included in the study. Group 1 consists of 30 patients who underwent intervention and Group II placebo group who are healthy participants. Clinically and sonographically diagnosed case of cholelithiasis and chronic cholecystitis underwent laparoscopic cholecystectomy by two senior consultant surgeons.
Results: The mean age of 60 patients was (37.33±9.837) years. More females 43 (71.7%) were in study as compared to males 17 (28.3%). On comparison, age, operative time, body mass index, VAS at 12th hour, VAS at 24th hour, there was statistically significant difference in pain score at 12 hours between intervention and placebo group, however, the difference was not significant at 24 hours.
Conclusion: Pulmonary recruitment manure is helpful in reducing early postoperative pain at 12hours however there was no difference in pain score after 24 hours.

Key Words: Laparoscopy induced shoulder pain, Laparoscopic cholecystectomy, Pulmonary recruitment maneuver, Visual analogue scale.

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INTRODUCTION

Laparoscopic procedures like cholecystectomy, hernia repair have become the standard of care all over the world because of less postoperative pain, small incisions, short hospitalizations, and earlier return to normal activity.[1,2] Thirty five to 80% Patients complain of shoulder and upper abdominal pain after laparoscopic procedures.[3] The trapped carbon dioxide between liver and diaphragm causes upper abdominal discomfort and irritation of phrenic nerve resulting in referred shoulder tip pain in the C4 dermatome.[4,5.] Abdominal and shoulder tip pain results in delayed recovery after laparoscopic cholecystectomy.[6]
Pulmonary recruitment maneuver (PRM) has been proposed to reduce shoulder and upperabdominal pain as it helps in evacuation of residual carbon dioxide by increasing intraabdominal pressure to facilitate the expulsion of residual carbon dioxide.[7]

Department of Surgery, Jinnah Hospital, Lahore.

Correspondence: Dr. Farooq Ahmad, Associate Professor of Surgery, AIMC/Jinnah Hospital Lahore.
Contact No: 0300-4102140
Email: drfarooqfcps@yahoo.com

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MATERIALS AND METHODS

This randomized control trial was conducted from May 2016 to June 2017 in the department of surgical unit-III, Jinnah Hospital Lahore. Sixty patients of symptomatic cholelithiasis age 16-60 years of both gender were included in the study. Non-probability purposive sampling technique was used for the induction of patients into the study. Patients with empyema gallbladder, gangrene, rupture and bile leakage and conversion to open surgery were excluded. Other exclusion criteria were diabetes, patients on antidepressants or antipsychotics, and BMI>40 kg/m^2 were excluded. Patients were randomly divided into two groups, manual pulmonary inflations group (intervention group) and control group. Both the patient and investigator responsible for recording of postoperative pain score were not aware of patient's group allocation. Treatment allocation envelop was opened by the anesthetist just before the procedure. Only the anesthetist was aware of the treatment allocation. Visual analogue scale (VAS) from 0 (no pain) to 10 (worst possible pain) was explained to the patients before surgery and was recorded at 12 and 24 hours post operatively. Laparoscopic cholecystectomy was performed with standard four port technique by

two senior consultants and pneumoperitoneum pressure was kept at 14 mm Hg in all the procedures.

On completion of the procedure, in the no intervention group (control group); the deflation of pneumoperitoneum was achieved by gentle compression of the abdomen. In the intervention group, after deflation of pneumoperitoneum pulmonary inflation was performed with a positive pressure for five times to expel residual gas. For postoperative analgesia, all patients were given 50 mg diclofenac sodium twice daily and tramadol HCL 20 mg 6hourly. Data was collected on a structured questionnaire containing age, sex, body mass index (BMI), VAS for recording of pain score. BMI more than 30kg/m^2 and duration of procedure operative time were treated as effect modifier and dealt by stratification. Data was analyzed using SPSS version 17.0, mean±standard deviation was used in qualitative variables like age, pain score on visual analogue scale, operative time and BMI. Frequencies and percentages are used for both qualitative and quantitative variables. An independent sample t-test applied to determine statistical difference in pain score at 12 and 24 hours in both groups (intervention and placebo groups). Data was stratified for duration of procedure and BMI. A p-vale ($p \leq 0.05$) was considered as significant.

RESULTS

The mean age of60 patients was (37.33±9.837) years ranging from 24 to 59 years were included in the study. Body mass index ranged from 26 to 38 with mean of (32.73±3.058) kg/m^2. While duration of operation ranging from 24 to 51 minutes with mean (37.62 ± 9.031) minutes (Table 1). Out of 60 patients participated in the study, 43(71.7%) were females and 17(28.3%) were males participants. Table 2 shows the 30 (50%) patients were randomly selected in intervention group and 30(50%) were randomly selected in placebo group. Table 3 presents the groups comparison by age, body mass index, operative time, and visual analogue scale (VAS) at 12^{th} hour and 24^{th} hours. On age comparison, mean age in intervention group was (37.17±9.833) and mean age of placebo group was (37.5 ± 10.006), however this difference was not statistically significant (p=0.61). On duration of operation time comparison, the mean intervention duration time was (35.93 ± 8.678) and mean placebo group duration time was (39.3±9.207), this difference was also not significant (p=0.15). In intervention group, the mean body mass index was (32.83±2.995) and in placebo group mean body mass index slightly differ (32.63±3.168), which also shows no difference. Comparison of groups VAS at 12 hours depicts that mean VAS scores at 12 hours in intervention group was (4.15±1.459) and in placebo group was (5.83±2.995), this difference is perfectly statistically significant (p=0.000). On group's comparison at VAS at 24 hours, the intervention group VAS mean scores was (3.32±1.214) and place group VAS mean scores was (4.63±2.85), the probability value shows no difference. Table 4 shows cross tabulation of both groups by gender. Moreover, of 43(100%) females, 19 (44%) were experienced intervention and 24 (56%) were in placebo group. 11 (64%) were selected in intervention group remaining 6 (36%) were in placebo group. Chi-square test shows no association between males and females in terms of intervention and placebo groups (p=0.836).

Table No.1: Distribution of sampled population (n=60)

Variable	No.	Mini	Max	Mean±SD
Age (years)	60	24	59	37.33±9.83
Body mass index	60	26	38	32.73±3.05
Operative time	60	24	51	37.62±9.03

Table No.2: Demographic profile

Variable	**No.**	**%age**
Gender		
Male	17	28.3
Female	43	71.7
Groups		
Intervention	30	50.0
Placebo	30	50.0

Table No.3: Comparison of different Variables in groups

Variables	Intervention group (n=30)	Placebo group (n=30)	P value
Age (years)	37.17±9.833	37.5±10.006	0.61
Duration of operation	35.93±8.678	39.3±9.207	0.15
Body mass index	32.83±2.995	32.63±3.168	0.802
VAS at 12 hours	4.15±1.459	5.83±2.995	0.000*
VAS at 24 hours	3.32±1.214	4.63±2.85	0.461

*Statistically Significant p<0.05.

Table No.4: Cross tabulation between Group & Gender

Group	Gender		Total	P value
	Female	Male		
Intervention	19 (44%)	11 (64%)	30 (50%)	0.836
Placebo	24 (56%)	6 (36%)	30 (50%)	
Total	43 (100%)	17 (100%)	60 (100%)	

*Statistically significant p<0.05

DISCUSSION

Despite all the advances in minimal access surgery, postoperative pain after laparoscopic cholecystectomy is still a serious problem, and about 80% patients have significant pain and require analgesia after laparoscopic cholecystectomy.[8] Radiologic studies demonstrate the presence of pneumoperitoneum for as long as 24 h after laparoscopic cholecystectomy.[9-10] Many patients (35–80%) have so far reported shoulder and upper abdominal pain after laparoscopic procedures.[3]Although the exact pathogenesis of postoperative pain is still not fully understood but the most plausible explanation of pain is carbon dioxide retention and irritation of diaphragm causes referred pain in C4 dermatome.[4] Likewise , residual carbon dioxide in subphrenic space also causes upper abdominal pain. It has been shown that gas insufflation with increased intra-abdominal pressure has a linear relationship between abdominal compliance during the procedure and the resultant severity of postoperative pain.[11]

To offer effective analgesia, along with NSAIDS and opioids pain modifying agents such as pregabalin and ketamine have also been investigated. All parenteral analgesics may be associated with adverse effects, so search for non pharmacological ways of managing pain have been investigated.[12-13]

In a similar study, active aspiration of CO2 resulted in less postoperative pain in the early postoperative hours than those patients where active evacuation of pneumoperitoneum was not done.[14] This shows that the active expulsion of the residual carbon dioxide after laparoscopic procedures results in less postoperative pain.

Pulmonary recruitment manoeuvre (PRM) has been proposed to reduce postoperative pain after laparoscopic cholecystectomy as it achieves the evacuation of residual carbon dioxide by increasing intraabdominal pressure. The study determines the mean difference in pain scores at 12 and 24 hours, results showed that there is a significant difference at 12 hours but the difference was non-significant at 24 hours. These results depict early reduction of pain in patients undergoing pulmonary recruitment manoeuvre secondary to increased washing of carbon dioxide. However, at 24 hours when there is equal rate of loss of abdominal distension the mean pain score was equally distributed in either groups. There is evidence that residual gas gets absorb after 24 hours of laparoscopy.[9-10] In another trial, patients in the active aspiration group of residual gas received less opioids compared to non aspiration group.[14] This difference of analgesia was most noticeable after one hour of surgery: (control group 3.9 *to*1.9 mg, intervention group 2.7 to1.3mg; P = 0.056).We suggest that at present sample size pulmonary recruitment manoeuvre is a cost effective simple technique to reduce early post-operative pain.

CONCLUSION

Pulmonary recruitment manure is helpful in reducing early postoperative pain at 12hours however there was no difference in pain score after 24 hours.

Author's Contribution:

Concept & Design of Study:	Muhammad Umar Farooq
Drafting:	Farooq Ahmad, Faisal Rauf
Data Analysis:	Faisal Rauf, Muhammad Iqbal
Revisiting Critically:	Muhammad Iqbal, Muhammad Umar Farooq
Final Approval of version:	Muhammad Umar Farooq

Conflict of Interest: The study has no conflict of interest to declare by any author.

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