Original Article

Shoulder Tip Pain in Laparoscopic Cholecystectomy with Active vs Passive Evacuation of Pneumoperitoneum

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Abstract

Objective: The objective of the study was to compare the frequency of severity of shoulder tip pain after active (gas suctioning) and passive removal of pneumoperitoneum among patient undergoing laparoscopic cholecystectomy.

Methods: This Observational comparative study was directed in general surgery department of DOW university hospital beginning from February 2016 to February 2017. Two hundred and six patients undergoing standard 4 port laparoscopic cholecystectomy were enrolled equally in either groups. The surgeon evacuated the abdomen by using a multiporous suction tube limiting the negative suction pressure to - 40 mmHg for 2-5 minutes under direct vision in active aspiration group, while in control group, CO₂ was removed passively. Pain scores were recorded using visual analog score at 16 hours post-operatively by residents of surgery blinded to the study.

Results: Mean VAS pain score at 16 hours in intervention group was much inferior than control group 1.00 ± 2.09 vs. 3.06 ± 2.58 (p < 0.001).

Conclusion: Active aspiration of CO₂ is an effective method that removes most if not all gas from the abdominal cavity. This will cause statistically significant decrease post-operative discomfort, pain and decrease need of rescue analgesics.

Key Words: Laparoscopic cholecystectomy, Pneumoperitoneum, Active Aspiration, shoulder tip pain, post-laparoscopic cholecystectomy pain

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Introduction

Laparoscopic cholecystectomy has largely replaced conventional open cholecystectomy.¹ It provides great satisfaction to patient and at the same time beneficial for the operating surgeon as well in terms of high grade visibility minimum operative time,

minimum anesthesia time, less postoperative pain, early mobilization, earlier discharges, and return to activities of daily life.^{2,3} Out of many reasons, patients prefer laparoscopic cholecystectomy over open cholecystectomy because of less post-operative pain most common of them are shoulder tip pain and right hypochondrium pain. Assortment of shoulder tip pain reported incidents are from 35% to 80% and may last for greater than 72 hours post-operatively.⁴

Post-operative shoulder pain and abdominal pain due to residual pneumoperitoneum leads to unpleasant discomfort and delay mobilization in spite of multiple doses of analgesics.^{2,5} It also leads to reduced intra operative urinary output, respiratory compliance, reduced cardiac output and decreased venous blood flow.^{3,5} The etiology of shoulder tip pain is multifactorial.² The shoulder tip pain due to residual CO₂ is also caused by stretching of diaphragm muscles and

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phrenic nerve irritation.² Therefore reduction in post laparoscopic cholecystectomy pain can be done by multiple methods like low pressure pneumoperitoneum, instillation of NSAIDS, instillation of intra-peritoneal local anesthesia, infiltration of wound with local anesthesia and removal of residual pneumoperitoneum.^{3,5,6,7} Various methods have been introduced like pulmonary recruitment maneuver consisting of two to five insufflations, at the end of procedure active suctioning of CO₂ or filling the abdomen with warm saline.^{1,4,8} Patient receiving abdominal filling with saline voided noticeable amount of urine following the immediate post-operativenight, disposes the patient to fluid overload and its time consuming.^{3,9} Pulmonary recruitment maneuvers carries risk of pneumothorax and increased morbidity.¹² It implies that none is proven to be as assuring to be a standard method. Since no local data is available, and there is no standard technique, the rationale of the study was to see the effect of active aspiration of CO₂ as a superior technique. The objective of the study was to compare the frequency of severity of shoulder tip pain after active (gas suctioning) and passive removal of pneumoperitoneum among patient undergoing laparoscopic cholecystectomy.

Methods

This observational comparative study was performed in general surgery department, DOW university hospital, from February 2016 to February 2017 over a period of one year after approval from research and training cell of CPSP. A total of 216 patients of either gender, age ranged between 20 to 60 years and undergoing interval laparoscopic cholecystectomy were included in the study. Pregnant females, HTN, COPD and DM, laparoscopic cholecystectomy converted to open cholecystectomy, ended in common bile exploration and Placement of drains were excluded. The Rao soft software was used for “sample size calculation”. Proportion of the incidence of shoulder pain varies from 35% to 80% and ranges from mild to severe with confidential interval of 95 %and margin of error of 9% sample size was n=108 in each group.⁴ All patients undergoing standard 4 port laparoscopic cholecystectomy were recruited in either of the 2 groups. Intervention group was labelled as group A and control group as group B. In Group A, the surgeon evacuated the abdomen by using a multiporous suction tube limiting the negative suction pressure to -40

mmHg for 2-5 minutes under direct camera view, while in group B, CO₂ was removed passively, trocars were removed and incisions were closed. Pain scores were recorded using visual analog score at 16 hours post operatively by residents of surgery blinded to the study Those patients, who experience moderate to severe pain in spite of routine analgesics received a single bolus dose of Diclofenac sodium 75mg intramuscular or injection Nalbuphine 5 mg intravenous maximum thrice in 24 hours if needed.

Statistical package of social science software, SPSS, version 16 was used for data analysis. Frequency and percentage quantitative variables and mean and SD of qualitative variables was calculated. To compare both groups, the chi-square test was used. P value of ≤ 0.05 was considered statistically significant.

Result

The study is based on total of 216 patients and none of them were excluded. Out of them, 108 were allocated I neither group by sealed enveloped method. Demographic variables are mentioned in table 1.

It was observed that 107 (91.1%) patients in control and 28 (25.9%) patients in case developed pain. P value < 0.001 for both groups.

The pain intensity was further characterized as no pain, mild moderate and severe pain based on Visual Analog Scale from 0 to 10. The results are as shown in graph 1. Over all Mean VAS score at 16 hours after laparoscopic cholecystectomy was 2.03 ± 2.56 . The score in control group which was much higher than case group (3.06 ± 2.58 vs. 1.00 ± 2.09).

After stratification in the context of effect modifiers, age, height, weight, BMI and period of surgery, it was found that all of them effect pain outcome. However it was observed that in age group between 20 – 30 years, no significant association was found with pain score (p value 0.77). Severity of pain score had significant association with age and BMI (p value < 0.001). However, BMI of range between 20-25 kg/m² had no association with the severity of pain (p value 0.438).

Discussion

Pain after laparoscopic surgery can occur in abdomen, either upper or lower, back or either shoulders.¹⁰⁻¹² It can be transient or lasting up to days.¹⁰

Shoulder tip pain was documented in 99.07% of the control group and 32.85 % of case group in our study. This shows that over all pain score in case group was

Table 1: Description Of Patient's Characteristics (n=216)

CHARACTERISTICS	CONTROL	CASE	P value
	n 108(%)	n 108 (%)	
AGE GROUPS			
20 – 30	72 (66.7)	12 (11.1)	<0.001
31 – 40	18(16.7)	31(28.7)	
41 – 50	18(16.7)	65(60.2)	
SEX			
Male	48 (44.4)	17(15.7)	<0.001
Female	60(55.6)	91(84.3)	
BMI			
20-25	61	31	<0.001
25-30	41	22	
35-40	6	55	
DURATION OF SURGERY			
< 30 mins	0	6(5.6)	<0.001
30-60 mins	54(50%)	41(38)	
61-120 mins	54(50%)	9(8.3)	
> 121 mins	0	52(52)	

Table 2: Description Of Analgesic Requirement N = 31

CHARACTERISTICS	CONTROL n(%)	CASE n(%)	P- value
ADDITIONAL ANALGESICS NAMES			
Toradol	18(58)	13(41.9)	<0.01
Toradol and Nalbuphine	18(58)	2(6.4)	
ADDITIONAL ANALGESICS FREQUENCY			
Once	18(58)	13(41.9)	<0.01
multiple	18(58)	2(6.4)	

significantly lower (p value <0.001).

Similar study conducted by Jasmin et al showed no pain 86.2% in the case group.⁴ The results are comparable with our study in which 78.8% of intervention group had no pain. In another research done by Fredman B et al., the active aspiration (AA) group in which gas was actively aspirated by suction, while no efforts, in the non-active aspiration (NAA) group, were made.¹³ Throughout the initial post-operative hour, lesser stresses were made by AA patients for morphine in comparison to those who belong to NAA group (15.3 ± 15.7 vs 31.3 ± 26.2) and also obtained a smaller dose of PCA morphine (2.7 ± 1.3 mg vs 3.9 ± 1.9 mg) $P=0.056$. This concluded that residual pneumoperitoneum was one of the important contributing factor leading postoperative pain as shown in previous studies in literature.^{13,14}

In a recent international study, patients experiencing mild, moderate and severe pain were 15.5%, 49.3 % and 35.2% from control group and 13.8% from intervention group experienced mild pain. However, none of the patient experienced moderate and severe pain.⁴ Whereas in our study, 7.4 % of Group A patient

had mild pain whereas 12% and 1.9% patients moderate and severe pain. One of the explanations can be difference of suction pressure used in either studies. It can be concluded to question the efficiency of various proposed method and some more trials should be conducted to decide which is the suitable one.

Figure 1: Stratification According to Pain and Severity of Pain

Results of our study are comparable with study conducted by Jasmin S et al. in which rescue analgesia was required by 33.1 % of the study population in contrast to only 14.3 % in our present study.⁴ Out of these, in contrast, their requirement of analgesia by control and case group were 50 % and 42.3% which was significantly higher than our study.^{4,15} This brights to highlight that patient's decrease demand of additional analgesia is an indirect measure of our maneour to evacuate pneumoperitoneum. Since no local data is available in our country, we do not have any standard guidelines for our population. The limitation f our study was a single center study with small sample size. Further studies are required so that a concerte guideline can be postulated and new standards of care can be postulated for the best intrest of patient.

Conclusion

Active aspiration of CO₂ is an effective method that removes most if not all gas from the abdominal cavity. This will cause statistically significant decrease post-operative discomfort, pain and decrease need of rescue analgesics

Conflict of Interest: None

References

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Author's Contribution

AA: Manuscript writing & data collection
NS: Manuscript writing & data processing
KAM: Data collection
KWA: Proof reading & correction
BMA: Proof reading & supervision
IHS: Data collection