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Effectiveness of pre-incisional port sites instillation of bupivacaine in reducing early postoperative pain after laparoscopic cholecystectomy

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ABSTRACT

Objective: To observe the effectiveness of pre-incisional port site instillation of local anesthetic Bupivacaine in reducing early postoperative pain after laparoscopic cholecystectomy.

Methodology: A Prospective Randomized controlled trial was performed at the Department of surgery, KRL Hospital, Islamabad from April to October 2016. Sixty patients in total undergoing laparoscopic cholecystectomy admitted through OPD/emergency department were included in the study by consecutive non probability sampling technique. Patients were randomized into intervention Group A and Control Group B. In Group A pre-incisional port sites were instilled with Bupivacaine, while in Group B no Bupivacaine was instilled at the port site. In both groups, all patients received Bupivacaine instillation intraperitoneal to mask the effect of visceral pain component from postoperative port site somatic pain.

Results: Out of total of 60 patients, in Group A, the mean age was 36.27 + 12.21 & in Group B was 35.57 + 11.12. Female: male ratio in group A was 5:1 and 4:1in group B. The ASA status for patients in Group A: 93.4% in ASA I, while 6.7% in ASA II. In Group B, patients with ASA I were 86.7% and 13.4% in ASA II. The mean VAS at "12" hours postoperatively for Group A was 3.70 + 2.20 & 5.13 + 2.22 for Group B with P value of 0.0150 which is statistically significant. So, statistically postoperative pain on VAS in Group A was lower than in Group B up to 12 hours post operatively. Concluding, a significant statistical difference was found for early postoperative pain between the two groups.

Conclusion: Pre-incisional, port-site infiltration of Bupivacaine reduces the frequency and intensity of postoperative pain in the early postoperative period of Laparoscopic Cholecystectomy. Thereby, reducing analgesic requirements and early discharge.

Keywords: Local anesthetic (Bupivacaine), Laparoscopic Cholecystectomy, Pre-incisional, Postoperative pain.

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Introduction

Gallstones are the commonest biliary pathology that affects 10-15% of the adult population in western societies. About >80% of these individuals remain asymptomatic. Approximately 1-2% of asymptomatic individuals develop symptoms requiring cholecystectomy per year. [1]

Open cholecystectomy remained the mainstay of treatment for symptomatic gallstones for the last 100 years. In 1980's introduction of Laparoscopic Cholecystectomy (LC) has changed the treatment of symptomatic gallstones dramatically and other benign gallbladder diseases.[2] Muhe

performed the first LC in 1985 and presented his work at the conference of German Surgical Society in1986[2], but he was ignored at that time.

Laparoscopic surgery had given rise to a new era in general surgery, which was intended to decrease the trauma of surgery without compromising the operative field exposure. The work of Lech in 1987 in laparoscopic surgery was refused by the surgical audience at that time, but later Phillipe Mouret in Loyns in 1988, Dubois in 1989 and Peters et al in 1991, LC finally gained attention and is now the "Gold Standard" surgical procedure for most of symptomatic gallstones disease.[3-6] Various studies have shown that inexperienced hands LC significantly reduces the postoperative pain, recovery period, and ultimately hospital stay without increasing mortality and morbidity.[7]

Though LC is the preferred procedure for the management of symptomatic gallstones, it has some disadvantages like time consumption, increased chances of CBD and visceral injury, other drawbacks like two-dimensional view, conversion risk to open surgery, need for expensive instruments, and shortage of trained manpower.[8]

Clear benefits have been established for LC as compared to open surgery in terms of postoperative pain[9], still some patients may experience considerable pain (60.5%) after LC as evident from the previous studies[10]. This pain can increase the hospital stay and morbidity too, which is particularly important now as LC is being done as a day case surgery in many centers.[10, 11]

Interestingly the pain experienced after LC is different from that of open cholecystectomy. As open cholecystectomy results mainly in parietal pain, most of the discomfort experienced after LC is due to visceral pain[12]. The visceral pain is usually felt at the shoulder tip as referred pain, which is defined as pain being referred from internal viscera to its corresponding somatic site due to phrenic nerve stimulation and CO_2 insufflation.[13]

The etiology of pain after laparoscopic cholecystectomy is complex. In addition to visceral pain the port site (somatic) incision pain after LC is also an important issue that usually peaks itself in the early postoperative period[14] and is the main reason for a longer hospital stay, thus preventing early discharge. Multiple research studies have been performed to find out the ways for reduction of postoperative port-site pain after LC.

The purpose and aim of this research work was to observe the effectiveness of pre-incisional instillation of bupivacaine on the reduction of postoperative pain after LC.

Methodology

This RCT was performed in the department of surgery KRL hospital, Islamabad from April 2016 to October 2016. Prior permission was obtained from ethical committee of the hospital to carry out the study. 60 patients were inducted by consecutive non probability sampling technique. Adult males and females aged between 18-60 years having symptomatic gallstones disease admitted through outpatient and emergency department with ASA class 1 and 2 were selected. Patients with a history of local anesthetic allergy, patients from ASA class 3 or above, and patients with associated diseases causing pain in the abdomen like Gastritis/APD, Renal stones, chest wall problems like osteochondritis, IBS, crohn's/ulcerative colitis were excluded. The lottery method was used to allocate the selected patients who gave written informed consent randomly into either of two groups. Patients included in Group A received bupivacaine at all four port sites before giving incisions, while on the other hand patients in Group B did not receive port site bupivacaine infiltration. In both the groups, all patients received 0.5 % Bupivacaine instillation into right sub-diaphragmatic space and gall bladder fossa to mask the effect of any visceral pain component from postoperative port site pain. 0.5 % Bupivacaine solution in dilution was used for the study. The dose was calculated according to the weight of the subject i.e. 2mg/kg and the calculated dose was diluted into 50ml of distilled water. In both groups (A & B),

- 10ml was infiltrated in the GB fossa.
- 10ml was infiltrated in the right sub-diaphragmatic space.
- 10ml was infiltrated in the left sub-diaphragmatic space.

This was done so that the concentration of bupivacaine instilled intraperitoneal remained same in both groups.

Whereas for Group A, in addition

- 20ml was instilled at the port sites i.e. 5ml each at four ports before giving incisions.

All of the laparoscopic cholecystectomies were done by the same specialist surgeon. Postoperative pain was observed at 12 hours after surgery using the Visual Analogue Scale (VAS), recorded by the trainee doctor, who was blinded from the group to which the patient

belonged. All findings were recorded in the proforma. Postoperatively, Ketorolac 30mg I.V was given according to visual analogue scale for pain (moderate to severe pain). A maximum of 90mg was given in any patient before switching over to Nalbuphine 4mg I.V in 5ml dilution. Data was collected in form of variables and was stored & analyzed on SPSS ver.20. Mean and Standard deviation were calculated for quantitative data including variables as age, pain. Frequency and percentage were calculated for qualitative data like gender. To compare postoperative port site pain in Group A and Group B, independent sample t-test was applied. P-value of less than or equal to "0.05" was taken as significant. Effect modifiers like age, gender and ASA 1, 2 were controlled by stratification. Student t-test was applied for post-stratification.

Results

Sixty patients in total were included in the study and randomized into two study groups as defined previously. All LC were performed in KRL Hospital, Surgical Department during six months period. The mean age in Group A was 36.27 $\pm$ 12.21 while in Group B was 35.57 $\pm$ 11.12 with minimum being 20 years in both groups and maximum 57 years in group A & 55 years in group B. The female to male ratio in Group A was 5:1 & 4:1 in Group B. The ASA status for patients in Group A: 93.4% in ASA I and 6.7% in ASA II. In Group B, patients with ASA I were 86.7% and 13.4% in ASA II. The mean VAS at "12" hours post operatively for Group A was 3.70 $\pm$ 2.20 and that of Group B was 5.13 $\pm$ 2.22 with the P value of 0.015 which is statistically significant (Table I)

At "12" hours post operatively, none of the patient in Group A and group B felt "no pain" while 15 (50%) patients in Group A and 5 (12%) patients in Group B felt "mild pain" according to VAS. The comparison of mean VAS at "12" hours between Group A and Group B, using Independent Sample t- Test, showed statistical significance with P value of 0.015 (Table II).

Table I: Mean Visual Analogue Score of patients at "12" Hours, postoperatively

	Group A (Bupivacaine Group)	**Group B** (Control Group)
N	30	30
Mean	3.70	5.13
Standard Deviation	2.20	2.22
Standard Error of Mean	0.40	0.41
P-value	0.0150	

Effect modifiers like age, gender and ASA status were controlled stratification. (Table III & IV)

Table II: Pain severity at "12" Hours

Group	**Intensity of Pain**	**N(%)**
Group A	**No Pain**	0(0)
	Mild Pain	15(50)
	Moderate Pain	12(40)
	Severe Pain	3(10)
	Total	30(100)
Group B	**No Pain**	0(0)
	Mild Pain	5(16.7)
	Moderate Pain	17(56.7)
	Severe Pain	8(26.7)
	Total	30(100)

Table III: Stratification for patient's VAS at 12 hours with regards to Age

Age Groups	**Group-A (n=30)**		**Group-B (n=30)**		**P value**
	Mean VAS at 12 Hours				
	Mean	**SD**	**Mean**	**SD**	
18 to 39 Years	3.23	1.88	4.83	2.255	0.029
40 to 60 Years	.30	2.496	5.58	2.193	0.18

Table IV: Stratification for patient's VAS at 12 hours with regards to Gender

Gender	**Group-A (n=30)**		**Group-B (n=30)**		**P value**
	Mean VAS at 12 Hours				
	Mean	**SD**	**Mean**	**SD**	
Males	2.6	0.894	5.16	1.471	0.006
Females	3.92	2.325	5.12	2.413	0.082

Discussion

The pain after LC arises due to multiple factors, the pain at port sites (somatic), gall bladder fossa (visceral) and as a consequence of pneumoperitoneum, which usually peaks itself in early postoperative period.[14] Several research studies have been conducted to find out ways to decrease postoperative pain after LC. Many trials have been conducted using pre-incisional local anesthetic instillation but results on pain reduction and the parenteral analgesics usage were still debatable.[15] While most of the studies have shown favorable results of reduced postoperative pain by pre-incisional port site use of local anesthetic[5] combined with intra-peritoneal infiltration of local anesthetic.[16, 17] However, few studies showed inconsistent and conflicting results showing that the port site local anesthetic agent instillation before giving incisions, do not influence the postoperative pain and analgesia

consumption, or any significant reduction in pain following LC.[6,18]

Intra-operative direct blockade of peripheral nerves, before starting LC, is a propitious strategy to decrease the postoperative pain and prevent the central sensitization as has been shown by many studies using different long acting local anesthetic agents like Bupivacaine[18], Ropivacaine[19] and Levobupivacaine.[20] Most studies have used bupivacaine but few studies have used levobupivacaine too, but with different timings and route of administration in those studies.[21] The half-life of Bupivacaine is 2.5 to 3.5 hours and reported to provide pain control for an average 6 hours (5-12 hours), the safety margin is wide with no significant side effects, about 100 mg can be safely used in patients with lean body mass of 40 kgs.[21]

Pre-incisional port site instillation of local anesthetic agent has also been demonstrated for early postoperative pain management following laparoscopic gynecological procedures and was found to substantially decrease the postoperative pain and analgesic utilization, with an overall high patient satisfaction rate.[22,23]

Cholelithiasis is more common in female patients and females were dominating over males with ratio of 4.45:1 in this study, which was very much similar to study conducted by Gupta RS et all in India[24]. The mean age in this study for Group A was 36.27 $\pm$ 12.21 and in Group B was 35.57 $\pm$ 11.12 which seconds the study conducted in Mexico.[13]

The ASA status of most patients fall in Class one (I) as compared to Class (II) with a ratio of 9:1. At 12 hours post-operatively mean VAS of Group A was 3.70 $\pm$ 2.20 and that of Group B 5.13 $\pm$ 2.22 with *P* value of 0.0150, which shows that pre-incisional port sites infiltration of Bupivacaine improves the overall pain post-operatively. A study conducted in Peshawar has also reported the similar findings.[13]

As a result of better pain control postoperatively, the frequency and dose of analgesics given were also lower in the intervention group than in control group which seconds the study performed in Mexico.[12]

Keeping in view of significant reduction of early postoperative pain with port site local anesthetic instillation, some of earlier research studies have supported our results and also shown a significant reduction in overall analgesia/opioids consumption and a decrease in the hospital stay as well.[4,20]

Although most of the studies have shown favorable results of reduced postoperative pain by pre-incisional port site use of local anesthetic[22], few studies conducted by Souto MM et all[25] in Brazil showed inconsistent and conflicting results, that the port site local anesthetic agent given before giving incisions does not influence the postoperative pain and analgesia consumption[23] or any significant reduction in pain following LC. [25]

In our study, we observed that variable intensity of pain was experienced by most of the patients in both groups and there is large variation in pain scores which is due to the different threshold of each patient as pain is a subjective phenomenon, it cannot be measured very accurately, even with VAS or any other method. We also noted that other factors like putting a drain and enlarging the port site for gallbladder removal also affected pain scores[12].

Conclusion

The pre-incisional port site instillation of bupivacaine reduces the mean pain postoperatively which in turn results in reduced requirement of injectable analgesics in the early postoperative period of LC.

Thus, based on these findings, it is concluded that port sites pre-incisional bupivacaine infiltration is simple, safe and inexpensive and an effective technique in reducing postoperative pain, so it can be recommended in routine use for all the cases of elective LC.

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