

Comparison Between Analgesic Effects of Pre-Operative and Post-Operative Trocar Site Infiltration of Injection Bupivacaine in Elective Laparoscopic Cholecystectomy

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ABSTRACT

Objective: To compare the analgesic efficacy of Local Anaesthetic infiltration with Bupivacaine at Trocar site in Laparoscopic Cholecystectomy when injected preoperatively vs postoperatively.

Study Design: Quasi-experimental study.

Place and Duration of Study: Department of General surgery, Combined Military Hospital, Rawalpindi Pakistan, from May to Nov, 2016.

Patients and Methodology: Patients meeting the inclusion criteria were randomly divided into two groups using coin method. Group A received pre-operative injection of Bupivacaine infiltrated at the trocar sites. Patients in Group B received the similar dosage post-operatively. The pain of the patients was assessed post-operatively using Visual Analog Score (VAS) at 6, 12 and 24 hours and compared.

Results: A total of 190 patients were equally divided into Group A and B (95 each). The mean age was 46 ± 13.77 years in Group A and 43 ± 14.80 years in Group B. 23.68% (n=45) of patients were aged between 12-24 years, 13.15% (n=25) were of 25-36 years, 22.63% (n=43) were aged 37-48 years and 40.52% (n=77) of the patients were between the age of 49-60 years. 75.78% (n=144) of patients were males, while 24.21% (n=46) were females. The Mean \pm SD VAS post-operative pain scoring Group A and Group B was 4.5 ± 0.04 vs 5.0 ± 0.40 , respectively. The *p*-value was < 0.001 and the difference is statically significant.

Conclusion: We concluded that the use of pre-operative local anesthesia helps reduce post-operative pain in patients undergoing laparoscopic cholecystectomy.

Keywords: Laparoscopic cholecystectomy, Mean pain score, Post-operative pain, visual analogue scale.

How to Cite This Article: Akhtar MU, Akhtar MT, Hussain SM, Akram ZJ, Akram MU, Abbas T. Comparison Between Analgesic Effects of Pre-Operative and Post-Operative Trocar Site Infiltration of Injection Bupivacaine in elective Laparoscopic Cholecystectomy. *Pak Armed Forces Med J* 2023; 73(Suppl-1): S40-44.
DOI: <https://doi.org/10.51253/pafmj.v73iSUPPL-1.2697>

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INTRODUCTION

Laparoscopic Cholecystectomy has now become the gold standard procedure for removal of gall bladder in cholelithiasis. The advantages over the conventional open cholecystectomy include less surgical trauma, less pain, fewer complications and early ambulation of the patient.¹ This has led to its use as a day case procedure. However, post-operative nausea, vomiting and pain are important factors for the delay in ambulation. Post-operative pain is due to stretching of the peritoneum, intra-abdominal drains, nerve damage during gas insufflations and inflammatory mediators' release.² However, abdominal pain accounts for delay in ambulation in around 60% of patients.³

Many strategies have been adopted to decrease post-operative incisions' pain, including local anesthetic infiltration, pre-operative NSAIDs, low pressure insufflation and use of steroids.^{2,4} For local

anesthetic infiltration, intra-peritoneal, intra-incisional, inter-costal blocks and intra-peritoneal aerosol infiltration have been studied using different anesthetic agents including Bupivacaine, Ropivacaine, Levobupivacaine and Tramadol.^{3,5} Similarly, timing of these interventions has been well studied. However, much of this research has been done in the developed countries.

Similar studies in our part of the world have shown some benefit.⁶⁻⁸ However, limited studies are available which compared the pre and post-operative usage of the same analgesic. Kashmiri *et al.*⁹ at Dow University of Health Sciences compared analgesic effects of different mode of local anesthetic administration in our population. Iqbal MA *et al.*¹⁰ also performed a similar study at Lahore. Yet, in spite of all this research, two systematic reviews have emphasized for further studies to determine the optimal combination and timing for these pain relief interventions.¹¹

In a similar study, Pappas G. *et al.*¹² showed that the patients had mean VAS scores of 4.5 ± 0.76 as compared to 5.0 ± 1.56 in pre and post local infiltration

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Received: 08 Apr 2019; revision received: 23 Jan 2020; accepted: 24 Jan 2020

Comparison Between Analgesic Effects

of local anesthetic, with a *p*-value of 0.033. However they used injection Ropivacaine.

In spite of all the above mentioned studies, limited local studies are available that compare the pre and post-operative effects of injection bupivacaine infiltration at the Port site, which was done in our study.

METHODOLOGY

The quasi-experimental study was conducted at Combined Military hospital, Rawalpindi from May to November, 2016. The study started after approval by the institution's research ethics committee. Sample size was calculated using WHO sample size calculator. Non-probability consecutive sampling was used to get the study sample.

Inclusion Criteria: Both male and female patients undergoing interval or elective Cholecystectomy for cholelithiasis, between the ages of 12 to 60 years and with an ASA I & II were included in the study.

Exclusion Criteria: Patients with acute cholecystitis, ASA III or above were excluded from the study. Those patients who were converted to open Cholecystectomy, had previous upper abdominal surgery, were allergic to bupivacaine or NSAIDs, were unable to comprehend VAS, had post-operative peritonitis, leakage or ligature slippage or those taking pain killers for other reasons, were also excluded from the study. Ethical issues were maintained by informing about confidentiality, such as data coding, disposal, sharing and archiving. Randomization was done via computer generated tables.

All the patients were anesthetized using the standard techniques. For initial port placement Hassan or open technique was used. Four ports technique was used. Two 10 mm ports were placed in the epigastrium and peri-umbilical region while two 5 mm ports placed at the subcostal area at the mid-clavicular and anterior axillary line. The abdomen was insufflated with carbon dioxide at 12-14 mmHg pressure.

The patients were then randomly divided into two groups using coin method. Group A received pre-operative injection bupivacaine 2mg/kg body weight in 20 ml of saline infiltrated at the trocar sites (5ml each), before the trocar insertion. Patients in Group B received the same dosage of drug post operatively at the trocar site in a similar manner.

Postoperatively, investigators, blinded to the group of the patients assessed the abdominal pain of the patient using Visual Analog Scale (VAS) at 6, 12

and 24 hours after surgery. The time of arrival in the postoperative ward was taken as zero hour post-operatively. Injection Tramadol 100mg I/V was given as rescue analgesic on demand of the patient or if the VAS score for abdominal pain exceeded 5. The mean VAS score of the patient was recorded. Mean VAS scores for each group were then compared.

Data analysis was done in SPSS (version-17). For quantitative variables like age and mean VAS pain score at 6, 12 & 24 hours, mean and SD were calculated. For qualitative variables like gender, percentages were calculated. Independent sample t-test was used to find the difference between mean scores of the post and pre Incisional local infiltration groups. *p*-value ≤ 0.05 was taken as significant.

RESULTS

A total of 190 cases fulfilling the inclusion/exclusion criteria were enrolled to compare the analgesic effects of pre-operative trocar site infiltration of injection Bupivacaine with post-operative trocar site infiltration in patients undergoing elective laparoscopic cholecystectomy for cholelithiasis in terms of mean VAS score.

The demographic data of the patients showed that most of the patients were within the age group of 49-60 years; 77(40.52%) and the least in between 25-36 Years; 25(13.15%). Mean age of each group being 46 ± 13.77 and 43 ± 14.80 years, respectively. There was no significant statistical difference in the data (Table-I). Gender distribution showed that 144 (75.78%) were males while 46(24.21%) were females (Table-II).

Table-I: Age Distribution (n=190)

Age Group	Group A n=95	Group B n=95	Total
12-24 Years	21(11.05%)	24(12.63%)	45(23.68%)
25-36 Years	14(7.36%)	11(5.78%)	25(13.15%)
37-48 Years	21(11.05%)	22(11.57%)	43(22.63%)
49-60 Years	39(20.52%)	38(20%)	77(40.52%)
Total	95(50%)	95(50%)	190(100%)
Mean & SD for Age	46 ± 13.77	43 ± 14.80	

Table-II: Gender wise Distribution (n=190)

Gender	Group A	Group B	Total
Male	71(37.36%)	73(38.42%)	144(75.78%)
Female	24(12.63%)	22(11.57%)	46(24.21%)
Total	95(50%)	95(50%)	190(100%)

The Mean \pm SD VAS pain scores in Group A & Group B were 4.5 ± 0.04 vs 5.0 ± 0.40 respectively. The *p*-value was < 0.001 (Table-III). The data was stratified for age and gender to control the effect modifiers (Table-IV & V).

Comparison Between Analgesic Effects

Table-III: Comparison of Mean vas Pain Score Post-Operation (n=190)

Mean Vas Pain Score	Group A (Mean±SD)	Group B (Mean±SD)	p-value
AT 6 HRS Post-OP	5.0±0.59	6.0±0.34	<0.01
AT 12 HRS Post-OP	4.5±0.04	5.0±0.46	
AT 24 HRS Post-OP	3.5±0.54	5.0±0.16	
Mean Vas Pain Score & SD	4.5±0.04	5.0±0.40	

Table-IV: Stratification of mean vas pain score with age (n=190)

Age	Mean Vas Pain Score	Group A (Mean±SD) n=95	Group B (Mean±SD) n=95	p-value
12-24 Years	At 6 Hrs Post-OP	6.0±0.54	6.3±0.41	<0.01
	At 12 Hrs Post-OP	4.5±0.08	6.0±0.53	
	At 24 Hrs Post-OP	4.0±0.53	5.0±0.22	
	Mean±SD	4.5±0.08	5.5±0.43	
25-36 Years	At 6 Hrs Post-OP	6.3±0.72	6.3±0.27	<0.01
	At 12 Hrs Post-OP	4.5±0.00	6.0±0.49	
	At 24 Hrs Post-OP	3.0±0.42	5.0±0.23	
	Mean±SD	6.3±0.72	6.0±0.49	
37-48 Years	At 6 Hrs Post-OP	5.0±0.69	6.0±0.43	<0.01
	At 12 Hrs Post-OP	4.5±0.00	5.0±0.17	
	At 24 Hrs Post-OP	3.0±0.00	5.0±0.03	
	Mean±SD	4.5±0.00	5.0±0.17	
49-60 Years	At 6 Hrs Post-OP	5.0±0.47	6.0±0.13	<0.01
	At 12 Hrs Post-OP	4.5±0.02	5.0±0.27	
	At 24 Hrs Post-OP	4.0±0.51	5.0±0.02	
	Mean±SD	4.5±0.02	5.0±0.33	

Table-V: Stratification of mean vas pain score with gender (n=190)

Gender	Mean vas Pain Score	Group A (Mean±SD) n=95	Group B (Mean±SD) n=95	p-value
Male	At 6 Hrs Post-OP	5.0±0.58	6.0±0.35	<0.01
	At 12 Hrs Post-OP	4.5±0.04	5.0±0.47	
	At 24 Hrs Post-OP	3.0±0.54	5.0±0.17	
	Mean±SD	4.5±0.04	5.0±0.41	
Female	At 6 Hrs Post-OP	5.0±0.64	6.0±0.26	<0.01
	At 12 Hrs Post-OP	4.5±0.02	5.0±0.35	
	At 24 Hrs Post-OP	3.0±0.57	5.0±0.14	
	Mean±SD	4.5±0.02	5.0±0.35	

DISCUSSION

Gall stone disease is one of the most common presenting disease. Its incidence has markedly increased in the modern era, ranging from 5% to 25% in the adult western population.¹³ In Pakistan the prevalence is reported at being 9% to 13% in various studies.^{14,15} However, only about 2% to 4% of people with gallstones become symptomatic each year.¹³ Cholecystectomy is the only definitive treatment option for gallstones.¹⁶ Laparoscopic cholecystectomy has become the most widely used modality for cholecystectomy and

most of the cholecystectomies are now performed laparoscopically.¹⁷

Laparoscopic cholecystectomy is increasingly being used as a day case surgery as it is less painful than open procedures. However post-operative pain still remains an important reason for delayed discharge.¹⁸ This postoperative pain can be incisional pain, shoulder pain, or abdominal pain. Incisional pain is due to the stimulation of the peripheral nociceptors of the skin and subcutaneous tissue during trocar insertion.¹⁹ The infiltration of local anesthesia at the trocar site has shown to reduce pain in many studies. Different anesthetic agents have been studied with positive results.²⁰ However the timing has also been implicated as an important factor. The use of preoperative analgesia has been studied not only in laparoscopic cholecystectomy but for different open surgeries.²¹ This study compared the analgesic effects of pre-operative and post-operative trocar site infiltration of injection Bupivacaine in elective laparoscopic cholecystectomies.

In our study group, 75.78% of patients were male and 24.21% were females. However studies show that the prevalence of cholelithiasis is more in women as compared to men. A study at Karachi showed the prevalence of 14.8% in females compared to 5.7% in men.¹⁵ Other studies in Pakistan showed similar results with a female predominance of 92%.²² These statistics are similar to those published in the international data.²³ This increased incidence in the female population means that more female patients should undergo LC as compared to the men and the studies are reflective of that. A study from Bangladesh comparing intraperitoneal bupivacaine with control showed that the male to female ratio of 1: 4.6 A study from Nepal comparing the timing of administration of trocar site LA, 83.3% of the patients undergoing LC were female and 16.7% were male.⁷ An Indian study also showed more female patients undergoing LC with a female to male ratio of 2:1.²⁵ In our study group the male to female ratio is the other way around. This may be due to the fact that the study was conducted in a military setup catering mostly for soldiers.

The mean age of patients in our study group was 46±13.77 years and 43±14.80 years in Group A and Group B respectively. Out of these, 23.68% of the patients were aged between 12-24 Years, 13.15% were aged 25-36 Years, 22.63% were 37-48 Years and 40.52% were aged 49-60 Years. A study done at Hyderabad, Pakistan showed that the prevalence of gall stones in a

Comparison Between Analgesic Effects

sample population was between 30-59 years of age.¹⁴ Another study done at Karachi showed the incidence of gall stones was highest in the age groups above 40 years.¹⁵ It is consistent with studies done in the western countries which the highest incidence of gall stones is age groups above 60 years of age.²³ For the population undergoing LC the distribution of age is similar, with most of the patients being in between 49 to 61 years of age.¹² In study from Nepal studying the preemptive use of LA in LC the mean age of the patients was 45.5 years.⁷ In our study, a significant group of people were also in the younger age group as well. This may be due to the fact that most of the patients at Combined Military Hospital were young soldiers.

In patients receiving preoperative trocar site LA infiltration (group A) the mean VAS pain score was 4.5 ± 0.04 compared to 5.0 ± 0.40 for patients receiving the same LA postoperatively (group B). This reduction in pain was uniform at 6, 12 and 24 hours in the group A patients compared to the group B patients. The *p*-value was 0.00001 which is statistically significant.

Studies done in different countries have also shown similar results. They demonstrated decrease in pain scores with the preemptive use of incisional LA but the difference was statistically insignificant. A study done in India compared the preemptive with postoperative use of local anesthesia in different procedures including laparoscopic cholecystectomy. They measured the post-operative pain scores at 6, 10 and 24 hours. Although there was a decrease in the average pain score but it was not statistically significant ($p=0.07, 0.06$ and 0.18 at 6, 10 and 24 hours).²⁵

Another study from India compared the pain scores of different types of pain (visceral, parietal, shoulder tip) by timing the combined use of both intra-abdominal and incisional local anesthesia. One group received both the intraperitoneal and intra incisional local analgesia before the surgery and the second group received both at the end of the surgery. They compared their VAS scores at 4, 8 and 24 hours. They showed that the post-operative VAS value was much less for the preemptive group of patients with $p < 0.05$ at 4 and 8 hours in visceral (Intra-peritoneal anesthesia) and parietal (Intra-incisional analgesia). However at 24 hours there was no statistically significant difference.²⁴

Similarly international studies have shown the preemptive incisional analgesia to be effective. A Greek study using Ropivacaine as the anesthetic agent showed a marked reduction in postoperative pain after preemptive incisional analgesia.¹²

Finally, results of most of the studies conducted in different populations of the world have shown the benefit of the use of preemptive incisional LA infiltration. Local anesthetic use; incisional or intraperitoneal, preoperative or postoperative, have shown to decrease pain after laparoscopic cholecystectomy in all the studies.

Results of our study have shown that overall the preemptive infiltration of bupivacaine reduces pain better than postoperative infiltration and the difference is statistically significant.

CONCLUSION

We concluded that the mean VAS pain score was lower in patients being administered incisional local anesthesia preoperatively as compared to post-operative administration after elective, uncomplicated laparoscopic cholecystectomy. There is a definitive role of preemptive local anesthesia in decreasing postoperative pain.

Conflict of Interest: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MUK: & MTA: Data acquisition, data analysis, critical review, approval of the final version to be published.

SMH: & ZJA: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

MUA: & TA: Conception, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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