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The Role of Local Infiltration of 0.25% Bupivacaine at the Port Sites in Patients with Laparoscopic Cholecystectomy to Control Early Post-Operative Pain

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Abstract

Background: Pain management constitutes a vital aspect of surgical procedures, with analgesics commonly employed for this purpose. However, the use of analgesics can be associated with certain complications. This study aimed to assess the role of local infiltration of 0.25% bupivacaine at the port sites in patients with laparoscopic cholecystectomy to control early post-operative pain. **Material & Methods:** This cross-sectional study was carried out in the Department of Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh from March 2022 to September 2022. As the study subjects, a total of 40 adult patients who underwent laparoscopic cholecystectomy for symptomatic gallstone disease enrolled purposively. Data were analyzed by using SPSS version 23.0 were applied. **Results:** In this study, group 1 had a mean NRS pain score of 2.55±0.6 at 6 hours and 4.1±1.21 at 12 hours, with the first analgesic given after 13.85±1.57 hours and a repeat dose after 22±2.29 hours. Group 2, however, had higher pain scores: 6.8±1.15 at 6 hours, and 7.95±0.6 at 12 hours, with the first analgesic administered after 2.75±0.72 hours, and a repeat dose after 9.5±1.15 hours. In group 1, 30.0% of patients required a single analgesic dose in the first 12 hours, with 75.0% needing a total of 2 doses. Only 5% required analgesics within the first 6 hours. In contrast, in group 2, nearly 90% needed analgesics within the first 12 hours, with all patients requiring analgesics within the first 6 hours. This difference was statistically significant ($p<0.05$). **Conclusions:** Local administration of 0.25% bupivacaine at the port sites following laparoscopic cholecystectomy appears to be more effective than conventional analgesics in reducing post-operative port site pain. Additionally, it reduces the dose and frequency of conventional analgesic consumption.

Keywords:- Local infiltration, Bupivacaine, Laparoscopic cholecystectomy, Gallstone disease, Analgesic

INTRODUCTION

Pain management is crucial in surgical procedures, often relying on analgesics which may present complications. Local anesthetics such as bupivacaine offer an alternative to mitigate post-operative pain and reduce

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analgesic use. Laparoscopic cholecystectomy has revolutionized gall bladder surgery for symptomatic cholelithiasis, becoming the standard technique. Since its inception, significant progress has been made in postoperative patient care, yet many avenues for exploration remain open.[1] Laparoscopic cholecystectomy has significantly reduced postoperative pain and facilitated shorter hospital stays, allowing patients to return to normal activities sooner.[2,3] Many centers now discharge patients on the first postoperative day, with outpatient procedures becoming more common in selected cases.[4,5] Given the impact of pain on discharge timing, effective pain management is crucial. Pain on the day of surgery, often localized to the right upper quadrant and shoulder, can be effectively managed with local anesthetic infiltration like bupivacaine into the wound sites.[6] Infiltration of local anesthetics into surgical wounds has demonstrated pain reduction in various procedures like cholecystectomy, herniorrhaphy, and gynecological surgeries.[7] Postoperative infusion of local anesthetics, either continuously or intermittently, has also proven effective in reducing pain and narcotic requirements.[8] Bupivacaine, with a half-life of 2.5 to 3.5 hours, provides pain relief for approximately 6 hours on average.[9] Its wide safety margin allows for up to 2.5mg/kg body weight of bupivacaine, ensuring safe administration in various patient populations.[9] There is disagreement among clinicians regarding the primary source of pain after laparoscopic procedures, with some attributing it to trocar placement and others to intraperitoneal dissection or pneumoperitoneum creation.[10] Various methods of local anesthetic administration, such as periportal infiltration and intraperitoneal spraying, have been explored, with inconsistent results.[11] The objective of this study was to assess the role of local infiltration of 0.25% bupivacaine at the port sites in patients with laparoscopic cholecystectomy to control early post-operative pain.

MATERIAL AND METHODS

This was a cross-sectional study that was conducted at the Department of Surgery in the Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh from March 2022 to 30th September 2022. In this study, 40 adult patients, regardless of gender, who underwent laparoscopic cholecystectomy for symptomatic gallstone disease were enrolled. Ethical approval was obtained from the hospital's ethics committee, and written consent was obtained from all participants before data collection. The inclusion criteria specified adult patients who underwent laparoscopic cholecystectomy and had ASA grades 1 and 2. The exclusion criteria of this study included patients with a history of allergy to Bupivacaine and those requiring conversion to open cholecystectomy. Patients were randomly allocated into two groups: Group 1 (LA group), who received local infiltration with bupivacaine, and Group 2 (non-LA group), who did not receive bupivacaine. All patients underwent pre-operative assessment, including history, physical examination, and laboratory evaluation. For assessing pain status, the numerical rating scale (NRS) scores were used [12]. Demographic and clinical information of all participants was recorded, and data were analyzed using SPSS version 23.0. A p-value <0.05 was considered statistically significant in the analysis.

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RESULTS

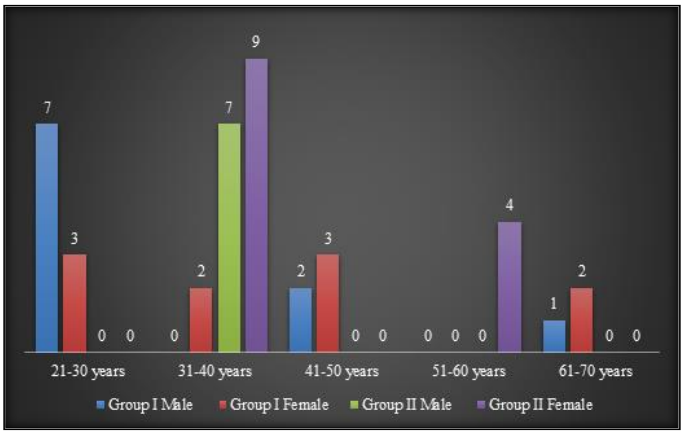

Figure 1: Age and gender of patients

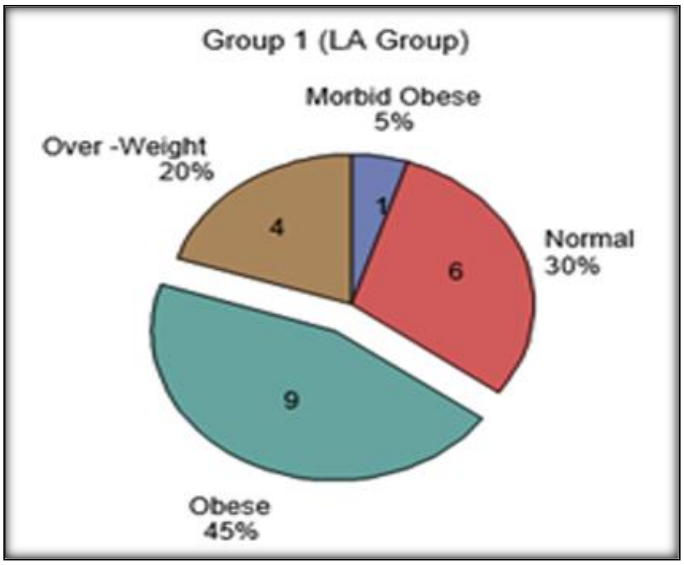

Figure 2: Body Mass Index (Group I)

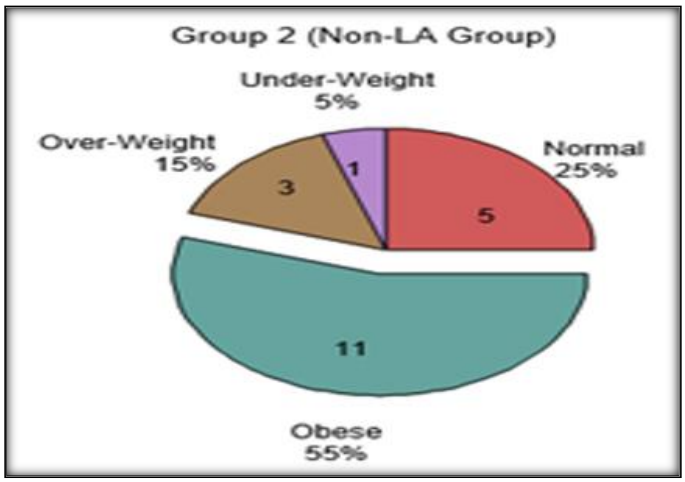

Figure 3: Body Mass Index (Group II)

In our study, group 1 comprised 14 female and 6 male respondents, while group 2 consisted of 13 female and 7 male respondents. The total number of respondents was 40, with 20 in each study group. In the 21-30 years age group, 7 female respondents and 3 male respondents were from group 1. In the 31-40 years age group, 2 females and 9 males were from group 1, while 7 males were from group 2. In the 41-50 years age group, 3 females and 2 males were from group 1. In the 51-60 years age group, only 4 female respondents were from group 2. Lastly, in the 61-70 years age group, 2 females and 1 male were from group 1. According to the Body Mass Index (BMI) status distribution, there was only 1 respondent classified as underweight, who belonged to group 2. Among those with a normal BMI, there were a total of 11 respondents, with 5 in group 2 and 6 in group 1. In the overweight category, there were 7 respondents, with 4 in group 1 and 3 in group 2. Among the obese, there were 20 respondents, with 9 in group 1 and 11 in group 2. Finally, in the morbidly obese class, there was only 1 respondent, who belonged to group 1. The mean numerical rating scale (NRS) scores of

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pain at 6 hours were significantly lower in group I (2.55±0.6) compared to group II (6.8±1.15) ($p<0.05$). Similarly, at 12 hours, the mean NRS scores were significantly lower in group I (4.7±1.21) compared to group II (7.95±0.6) ($p<0.05$). The mean time to the first analgesic administration was significantly longer in group I (13.85±1.57 hours) compared to group II (2.75±0.72 hours) ($p<0.05$). Similarly, the mean time to repeat the analgesic dose was significantly longer in group I (22±2.29 hours) compared to group II (9.5±1.15 hours) ($p<0.05$). According to the distribution of study patients by analgesic dose, it was observed that 30.0% of patients in group I required analgesic doses, while in group II, the majority (90.0%) needed analgesics. In the second 12 hours, 60.0% of patients in group I and 70.0% in group II required analgesics. The difference between the two groups was statistically significant ($p<0.05$). Within 24 hours, it was observed that in group I, 20% of patients required a single dose of analgesics, 75% needed 2 doses, and 5% needed 3 doses. In contrast, in group II, 30% of patients needed at least 3 doses of analgesics, 60% needed 4 doses, and 10% needed 5 doses. The difference between the two groups was statistically significant ($p<0.05$). In the first 6 hours, only one patient (5.0%) in group I needed analgesics, while all 20 patients (100%) in group II required analgesics. This difference was statistically significant ($p<0.05$) between the two groups.

Table 1: NRS scores at 6 and 12 hours

Scores at	**Group I**	**Group II**	**P-value**
	Mean ±SD	**Mean ±SD**	
6 hours	2.55±0.6	6.8±1.15	0.001
12 hours	4.7±1.21	7.95±0.6	0.001

Table 2: Time (hours) of analgesic doses

Dose	**Group I**	**Group II**	**P-value**
	Mean ±SD	**Mean ±SD**	
First	13.85±1.57	2.75±0.72	0.001
Repeat	22±2.29	9.5±1.15	0.001

Table 3: Analgesic dose distribution

Analgesic dose	**Group I**		**Group II**		**P-value**
	(n=20)		**(n=20)**		
	n	**%**	**n**	**%**	
Analgesic dose in 1st 12 hours					
0	14	70	0	0	0.001
1	6	30	0	0	
2	0	0	18	90	
3	0	0	2	10	
Analgesic dose in 2nd 12 hours					

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0	1	5	0	0	0.540
1	7	35	6	30	
2	12	60	14	70	

Table 4: Total analgesic doses (24 hours)

Total dose	**Group I**		**Group II**		**P-value**
	n	**%**	**n**	**%**	
1	4	20%	0	0%	0.001
2	15	75%	6	30%	
3	1	5%	12	60%	
4	0	0%	2	10%	

Table 5: Needed analgesia in 1st 6 hours

Analgesic	**Group I**		**Group II**		**P-value**
	n	**%**	**n**	**%**	
0	19	95%	0	0	0.001
1	1	5%	20	100%	

DISCUSSION

This study aimed to assess the role of local infiltration of 0.25% bupivacaine at the port sites in patients with laparoscopic cholecystectomy to control early post-operative pain. In this study, the mean numerical rating scale (NRS) of pain at 6 hours was 2.55±0.6 in group I and 6.8±1.15 in group II, with a statistically significant difference ($p<0.05$) between the two groups. Similarly, Alam et al. observed that at 6 hours postoperatively, the mean pain score in group I was 6.08±0.40 compared to 8.44±0.51 in group II, also showing a significant difference ($P<0.05$).[13] It has been noted that bupivacaine, with a half-life of 2.5 to 3.5 hours, can provide pain relief for about 6 hours.[9] The safety margin of bupivacaine for anesthesia is wide, allowing for its safe use at appropriate doses. In this study, the mean numerical rating scale (NRS) of pain at 12 hours was 4.1±1.21 in group I and 7.95±0.6 in group II, showing a statistically significant difference ($p<0.05$) between the two groups. Similarly, at 12 hours postoperatively, the mean NRS score was 4.72±0.61 in group I compared to 6.08±0.64 in group II, also indicating a significant difference ($P<0.05$). Previous studies have shown that bupivacaine effectively reduces pain intensity during the initial 12 hours following laparoscopic procedures. However, the etiology of postoperative pain varies; some attribute it to trocar insertion through the abdominal wall,[14] while others cite intra-peritoneal dissection and CO2 insufflation. In randomized controlled trials, researchers like Alexander and Sarac observed reduced pain intensity and opioid requirements with incisional local anesthetics, whereas Ure did not find similar reductions when local anesthetics were infiltrated into the abdominal wall.[14,15] Alam et al. demonstrated a modest overall analgesic effect, although they noted a statistically significant difference during the first 6 and 12 hours.[13] Cuniffe found a significant decrease in shoulder tip pain after

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intraperitoneal bupivacaine, a result consistent with Bisgaard's observations in their randomized control study.[16,17] The importance of pain relief and patient comfort during the early postoperative period, as well as the potential delay in the need for the first analgesic in Group I, were also highlighted by Alper et al., and Kehlet et al.[18,19] In our study, the mean repeat dose of analgesic was 22±2.29 hours with a range from 18 to 26 hours in Group I and 9.5±1.15 hours with a range from 7 to 11 hours in Group II. The early repeat dose of analgesic in Group II was also significantly ($p<0.05$) observed, consistent with findings by Bisgaard et al.[17] In this study, 75.0% of patients in group I received a total of 2 doses within 24 hours, while 60.0% of patients in group II received a total of 4 doses within the same timeframe. The mean total dose requirement within 24 hours was 1.85±0.49 in group I and 3.80±0.62 in group II, with the latter being significantly higher ($p<0.05$). Alam et al. reported a mean total analgesic requirement of 1.91±0.61 in the study group and 2.50±0.51 in group II.[13] The total dose requirement was significantly lower in group I compared to group II, consistent with findings by Cantore et al., who also observed a significant difference in intravenous dose between the two groups.[20] In this study, it was found that only 5.0% of patients required analgesics within the first 6 hours in group I, whereas all patients in group II required analgesics during the same timeframe. This disparity was statistically significant ($p<0.05$) between the two groups. The higher demand for analgesics in group II at 6 hours can be attributed to the earlier use of analgesics and the gradual waning of the effect of bupivacaine (with a duration of action of 6 hours) in group I. Szem et al. reported similar findings, stating that intra-peritoneal bupivacaine administered before surgery provided pain relief only for the first 6 hours postoperatively, without reducing analgesic consumption.[9] Chundrigar et al. also observed a modest overall analgesic effect, with a significant difference noted during the first 6 hours.[21] Laparoscopic cholecystectomy has significantly reduced post-operative pain and facilitated shorter hospital stays, allowing patients to return to normal activities sooner.[2] While most patients are discharged within the first post-operative day, recent studies suggest that outpatient procedures are feasible for selected patients.[22]. Effective pain management is crucial in the early post-operative period to prevent delays in discharge. Patients typically experience diffuse abdominal pain, particularly in the right upper quadrant and right shoulder tip, on the day of surgery.[6] Infiltration of local anesthetics into the operative wound has been shown to decrease post-operative pain in patients undergoing herniorrhaphy and gynecological procedures.[7,22]

Limitation of the study

This study excluded patients with comorbid conditions and pediatric patients, and did not assess port-related delayed complications. These exclusions may limit the generalizability of findings to broader patient populations and the understanding of potential complications associated with port usage.

CONCLUSIONS

Local administration of 0.25% bupivacaine at the port sites following laparoscopic cholecystectomy emerges as a promising strategy for managing post-operative port site

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pain. This approach demonstrates superior effectiveness compared to conventional analgesics, offering significant relief to patients. Additionally, it contributes to a reduction in the required dose and frequency of conventional analgesics consumption, potentially minimizing the risk of associated side effects. By targeting pain at its source with localized bupivacaine administration, healthcare providers can enhance post-operative pain management outcomes, improve patient comfort, and promote a faster recovery following laparoscopic cholecystectomy.

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