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A Study To Evaluate The Role Of Intraperitoneal Bupivacaine For Post Operative Pain Relief In Patients Undergoing Laparoscopic Cholecystectomy

[1]Dr. Aamir Pathan, [2]Dr. Manoj Kumar Gupta, [3]Dr. Dayaram, [4]Dr. Deepak Gupta
[1]Senior Resident, [2]Assistant Professor Surgery,[3]Assistant professor, [4]Head of Department,
Department Of Surgery,
[1,2,3]Government Medical College, Kota
[4]Maharaja Agrasen Hospital New Delhi

***Corresponding Author:**
Dr. Aamir Pathan
Senior Resident, Department Of General Surgery, Government Medical College, Kota

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Abstract

Background: Postoperative pain management in ambulatory surgery is crucial for timely patient release and recovery. Traditional opioid use presents challenges, leading to increased interest in nonconventional approaches. Laparoscopic cholecystectomy (LC) is a widely performed minimally invasive surgery, yet postoperative discomfort persists. The study focuses on optimizing pain management by evaluating the impact of intraperitoneal 0.5% bupivacaine after LC.

Methods: A prospective case-control study with 140 patients undergoing LC at Maharaja Agrasen Hospital, New Delhi, assessed the effectiveness of intraperitoneal bupivacaine. Patients were randomly assigned to Group A (received bupivacaine) or Group B (control). Data collection included demographics, intraoperative details, and postoperative assessments at intervals up to 24 hours.

Results: Group A demonstrated significantly lower postoperative pain scores ($p < 0.05$) compared to Group B. Pulse rate and systolic blood pressure were comparable at baseline but showed significant differences at various postoperative intervals favoring Group A. Visual Analog Scale scores for pain were consistently lower in Group A across multiple time points.

Conclusions: Intraperitoneal 0.5% bupivacaine instillation significantly reduced postoperative pain after LC, emphasizing its potential in multimodal pain management. The study contributes valuable insights into optimizing postoperative pain relief, particularly in the context of laparoscopic surgery. The discussion underscores the importance of drug concentration and administration techniques for optimal clinical outcomes.

Keywords: Postoperative pain, Laparoscopic cholecystectomy, Bupivacaine, Pain management, Ambulatory surgery, Multimodal analgesia

Introduction

A major concern for both surgeons and anesthesiologists is adequate postoperative pain management given the ever-changing environment of ambulatory surgery and the need to improve early hospital release. Unchecked postoperative pain sets off a series of negative events that include increased systemic vascular resistance, elevated cardiac activity, nausea, vomiting, delayed pulmonary function recovery, and limited mobility that might result in thromboembolic problems.[1] The timely and safe release of a patient from the surgical facility is greatly influenced by the effectiveness of pain management following surgery, which also has a tremendous effect on the patient's capacity to return to their regular activities.[2]

Although opioids have long been essential for providing postoperative analgesia, their broad usage has been linked to a number of negative consequences, including drowsiness, nausea, ventilatory depression, and extended hospital stays.[3] The excessive use of opioids after surgery and its negative effects on patient satisfaction have drawn attention from the Joint Commission on Accreditation of Health Organizations. In order to treat perioperative pain and reduce side effects, practitioners are increasingly looking into nonconventional ways as they become aware of the limits of traditional opioid administration.[4]

The development of laparoscopic methods, in particular laparoscopic cholecystectomy (LC), has completely changed how patients recover from surgery. LC has surpassed open cholecystectomy to become one of the most performed operations in general surgery, with short hospital stays and an early return to regular activities. There has been a boom in interest in laparoscopic operations due to the minimally invasive aspect of the technique, which leads to less tissue stress, fewer adhesions, and a concomitant drop in patient morbidity.[5]

Even with the benefits of laparoscopic procedures, postoperative discomfort is still a major problem. Inflammatory mediators may be released, the abdominal wall stretching that occurs during pneumoperitoneum, or the peritoneum may become irritated as a result of blood, bile leakage, or the CO2 utilized during the procedure. This pain, which is frequently felt the day following surgery, might be abdominal, parietal, or present as shoulder pain. It may cause discomfort for the patient and postpone release.[6]

A range of multimodal strategies, such as parenteral analgesics, local anesthetic infiltrations, intrathecal and epidural opioids, and intraperitoneal methods, have been investigated in recognition of the critical need of providing prompt pain relief on the day of surgery.[7] Polypharmacy, on the other hand, has the potential to cause damage to patients and increase the risk of readmission. Given this, the goal of the current study is to provide important new information about optimizing postoperative pain management in the era of laparoscopic surgery by assessing the impact of intraperitoneal instillation of 20 ml of 0.5% bupivacaine for pain relief following laparoscopic cholecystectomy.[8]

Materials and Methods:

This prospective case-control study was conducted at Maharaja Agrasen Hospital, New Delhi, with approval from the Departmental Review Board and Institutional Ethics Committee. The study focused on 140 in-patients undergoing Laparoscopic Cholecystectomy during the period from January 1, 2018, to December 31, 2018.

Study Design:

1. **Place of Study:** Maharaja Agrasen Hospital, New Delhi
2. **Type of Study:** Prospective Case Control Study
3. **Sample Size:** 140
4. **Study Period:** January 1, 2018, to December 31, 2018
5. **Study Population:** Patients undergoing Laparoscopic Cholecystectomy

Data Collection:

1. Inclusion Criteria: Patients aged >16 years undergoing Laparoscopic Cholecystectomy, providing consent.
2. Exclusion Criteria: Patients with gall bladder perforation, bile contamination of peritoneum, drain placement intraoperatively, allergy to oral bupivacaine, uncontrolled medical diseases, or recent use of NSAIDs/steroids.

Procedure:

1. Patients meeting inclusion criteria underwent routine assessments.
2. Personal details and medical history were recorded.
3. Patients were randomly assigned to study (received 20 ml 0.5% intraperitoneal bupivacaine) or control group (no bupivacaine).
4. Intraperitoneal bupivacaine was administered at right subdiaphragmatic space and gall bladder bed in the study group.
5. Both groups were assessed postoperatively at intervals (4, 8, 12, 16, 20, 24 hours) for surgical site and referred pain using Visual Analog Scale (VAS).
6. Analgesic requirement and NSAID (inj. Dynapar 75mg) administration were monitored.

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7. Values from VAS and analgesic consumption were compared between study and control groups.

Sample Size Calculation:

1. Sample Size Formula: $n = Z^2 \times p \times q / ME^2$
2. Critical Z Score (95% confidence level): 1.96
3. Prevalence (p): 10%
4. Margin of Error (ME): 5%
5. Calculated Sample Size (n): 140

Statistical Methods:

1. Statistical Package: SPSS 17.0
2. Continuous Variables: Presented as mean and SD
3. Categorical Variables: Expressed as frequencies and percentages
4. Statistical Tests: Student's t test for normally distributed continuous variables, Chi-squared test or Fisher's exact test for nominal categorical data.
5. Significance Level: $p < 0.05$

Results

Table 1: Frequency distribution of age groups of patients

Age groups	Group A (Cases) (n=70)	Percentage (%)	Group B (Controls) (n=70)	Percentage (%)
≤30	12	17.2	8	11.4
31-40	15	21.4	22	31.4
41-50	25	35.7	27	38.6
51-60	18	25.7	13	18.6
Total	70	100	70	100
Mean ±SD	42.67 ± 11.21		41.92±9.70	
Min-Max	18-60		21-60	

Our study included 140 patients. Patients were randomly categorized into two groups viz. patients in group A (intraperitoneal 0.5% bupivacaine, Cases) and group B (no intraperitoneal

0.5% bupivacaine, controls). Group A included 12 (17.2%) patients in age group ≤30, 15 (21.4%) in age group 31-40, 25 (35.7%) in age group 41-50 and 18 (25.7%) in age group 51-60 years old. Mean age for group A patients was found to be 42.67 ± 11.21. Youngest patient enrolled was 18 years old while oldest one was 60 years old.

In group B; 8 (11.4%) patients were in age group ≤30, 22 (31.4%) patients in 31-40 age group and 27 (38.6%) in 41-50 years old and 13 (18.6%) patients in 51-60 age group. Mean age was calculated as 41.92±9.70. Youngest patient was 21 years old and oldest one was 60 years old.

Table 3: Distribution based on comparison of pulse rate at different time points between group A and group B

Pulse rate	Group A (Cases)	Group B (Controls)	t-value	df	p-value
At 0 Hr	77.77±5.79	75.91±4.47	-2.127	138	0.0352
At 4 Hrs	76.4±4.84	75.6±3.32	-1.140	138	0.2561

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At 8 Hrs	75.51±4.06	74.94±2.69	-0.979	138	0.3292
At 12 Hrs	76.6±4.03	74.34±2.74	-3.871	138	0.0002

Mean value for group A at time of extubation was found to be 77.77 and that of group B was found to be 75.91. p value was found to be significant (0.0352). Also, association between group A and Group B pulse rate at 12 Hrs was found to be very significant with p value 0.0002. Significant difference was spotted between means of group A and B. Higher mean values were seen in Group A patients

Table 4: Distribution based on comparison of systolic blood pressure at different time points between group A and group B

SBP	Group A (Cases)	Group B (Controls)	t-value	df	p-value
At 0 Hr	132±12.69	126.42±15.69	-2.309	138	0.0224
At 4 Hrs	119.85±11.60	123.28±11.63	1.745	138	0.0832
At 8 Hrs	123.28±10.03	120.28±10.06	-1.766	138	0.0796
At 12 Hrs	120.57±10.47	125.14±10.03	2.636	138	0.0093

Systolic blood pressure; upon comparison was found to be significantly higher in group A patients than group B patients at the time of admission. Mean value at the time of admission for group A was 132 and for group B was 126.42.

At 12 hrs post operatively, systolic blood pressure was significantly lower in group A patients.

Mean values for group A and B were 120.57 and 125.14 respectively.

Table 6: Distribution based on comparison of VAS score at different time points between group A and group B

VAS	Group A (Cases)	Group B (Controls)	t-value	df	p-value
At 4 Hr	4.8±1.62	5.64±1.66	3.032	138	0.0029
At 8 Hrs	4.61±1.35	5.22±1.39	2.643	138	0.0092
At 12 Hrs	4.48±1.11	5.05±1.54	2.505	138	0.0134
At 16 Hrs	4.38±1.45	5.04±1.69	2.457	138	0.0152
At 20 Hrs	4.25±1.28	4.84±1.72	2.280	138	0.0241
At 24 Hrs	3.97±1.41	4.51±1.11	2.524	138	0.0127

Post-operative pain was assessed using VAS method. In group A patients, who were given bupivacaine intraperitoneally; pain was significantly lower than group B patients who were not given bupivacaine. P values at 4, 8, 12, 16, 20 and 24 hours were calculated as 0.0029, 0.0092,

0.0134, 0.0152, 0.0241 and 0.0127 respectively.

Discussion

The purpose of the study was to evaluate the effectiveness of intraperitoneal 0.5% bupivacaine in reducing pain after laparoscopic cholecystectomy. Even with the well-established benefits of minimally invasive surgery, laparoscopic patients frequently endure significant pain following their surgeries; shoulder tip and post-operative discomfort are two

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major causes for worry. In the current study, 140 patients were randomized to either Group A, which received 20 milliliters of intraperitoneal bupivacaine at a 0.5% concentration, or Group B, which did not receive any bupivacaine at all.[9]

Our study's findings showed that patients who received intraperitoneal bupivacaine (Group A) had significantly lower postoperative pain scores than those who did not (Group B). This result is in line with other research showing the effectiveness of intraperitoneal bupivacaine as an analgesic. Nonetheless, there are notable differences in the literature, with several trials showing no discernible decrease in pain.[10] According to our findings, obtaining efficient pain relief depends critically on the local anesthetic agent's concentration, volume, and total dosage. This emphasizes the significance of these parameters in clinical practice.[11]

In our investigation, the pharmacokinetics of bupivacaine were taken into account, highlighting the critical period between the administration of the medication and the evaluation of pain. Both the anesthetic's local effect and its absorption from the broad surface area may be responsible for Group A's persistent reduction in pain ratings over the first 24 hours following surgery. This length of effect is consistent with certain studies that indicate pain reduction for up to 24–48 hours following surgery, in contrast to other research that found only slight decreases for 2–8 hours.[12]

The numerous types of postoperative pain, such as somatic, visceral, and shoulder tip pain, were not particularly distinguished in our study. However, it implies that intraperitoneal bupivacaine, particularly at elevated concentrations, could be a useful treatment for general pain. In contrast, research has shown that intraperitoneal bupivacaine is ineffective in preventing visceral and incisional pain components.[13]

The study examined the effects of intraperitoneal bupivacaine on postoperative nausea and vomiting (PONV) in addition to pain alleviation. Our findings demonstrated a statistically significant difference between the groups, indicating the possible antiemetic effects of intraperitoneal bupivacaine, despite some studies reporting a reduced incidence of PONV with bupivacaine.[14]

Conclusion

In conclusion, the findings of this study substantiate the significant effect of intraperitoneal 0.5% bupivacaine instillation in reducing postoperative pain after laparoscopic cholecystectomy. The discussion contextualizes these results within the existing body of literature, emphasizing the need for careful consideration of drug concentration and administration techniques for optimal clinical outcomes.

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