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ORIGINAL RESEARCH

A Comparative Study on the Analgesic Efficacy of Levobupivacaine Alone Versus Its Combination with Nalbuphine in Wound Infiltration Technique for Lower Abdominal Surgeries under General Anesthesia

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ABSTRACT

Background: Postoperative analgesia in contemporary anaesthesia utilizes a variety of sophisticated methods, including intravenous non- steroidal anti- inflammatory drugs (NSAIDs), opioids, epidural analgesia, regional nerve blocks, and wound infiltration techniques. The present study was conducted to compare analgesic efficacy of levobupivacaine alone and in combination with nalbuphine in the wound infiltration technique for lower abdominal surgeries under general anaesthesia.

Materials & Methods: 56 patients aged between 18 and 60 years with ASA grades I, II, and III, who were scheduled for elective lower abdominal surgeries of both genders were divided into 2 groups. Group I received 18 mL of 0.25% levobupivacaine plus 2 mL of 0.9% normal saline (total of 20 mL), while group II received 18 mL of 0.25% levobupivacaine plus 2 mL of nalbuphine (20 mg). Hemodynamic parameters like heart rate (HR), systolic blood pressure (SBP), and diastolic blood pressure (DBP) were monitored at intervals in the Post Anaesthesia Care Unit (PACU) and at 30 minutes, 1 hour, 2 hours, 4 hours, and 6 hours after surgery.

Results: The mean age was 48,2 years in group I and 48.5 years in group II. There were 18 males and 10 females in group I and 15 males and 13 females in group II. The mean weight was 60.4 kgs in group I and 61.2 kgs in group II. The mean height was 154.2 cms in group I and 156.4 cms in group II. ASA grade (1/2/3) was seen in 12/13/3 in group I and 13/14/1 in group II. The mean duration of analgesia was 4.5 hours in group I and 9.1 hours in group II. The difference was non- significant (P> 0.05). In group I and group II, mean pulse rate (PR) at baseline was 82.4 and 80.6, at intraoperatively was 78.2 and 76.4 and postoperatively was 76.4 and 72.2 respectively. The mean SBP (mm Hg) at baseline was 124.2 and 120.4, intraoperatively was 128.6 and 118.2 and postoperatively was 126.4 and 116.6 respectively. The mean DBP (mm Hg) at baseline was 82.4 and 80.4, intraoperatively was 84.2 and 78.6 and postoperatively was 80.6 and 74.2 respectively. The difference was non-significant (P> 0.05). Quality of analgesia was 1 seen in 5 and 7, 2 in 12 and 14, 3 in 6 and 7 and 4 in 5 and 0 patients in group I and II respectively. The difference was non- significant (P> 0.05).

Conclusion: In patients undergoing abdominal surgeries, the use of levobupivacaine combined with the adjuvant nalbuphine yielded good to excellent quality analgesia without any side effects.

Keywords: Abdominal surgeries, Levobupivacaine, Nalbuphine

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INTRODUCTION

In clinical practice, providing pain relief after lengthy, uninterrupted surgeries is a significant medical challenge. Insufficient pain management can result in unfavorable patient outcomes and a postponement of discharge.[1] Postoperative analgesia in contemporary anaesthesia utilizes a variety of sophisticated methods, including intravenous non- steroidal anti-inflammatory drugs (NSAIDs), opioids, epidural analgesia, regional nerve blocks, and wound infiltration techniques. Recently, single wound infiltration using local anaesthetic or continuous local infusion via a catheter at the surgical site has been incorporated into multimodal analgesia for various surgeries performed under general or regional anaesthesia.[2]

Acute postoperative pain following lengthy abdominal surgeries can cause hemodynamic instability, reduced pulmonary function after surgery, and a prolongation of recovery time and hospital stay.[3] Infiltrating wounds with local anaesthetics is a straightforward and efficient approach to alleviating postoperative pain following various surgical procedures, and it typically does not result in significant side effects. The wound infiltration technique operates by directly blocking nociceptive afferent pain pathways from the wound surface and diminishing the local inflammatory response to injury.[4]

As surgical pain mainly arises from the site of the surgical wound, employing local anaesthetics at this location is an effective method for managing perioperative pain. Levobupivacaine is a long-acting local anesthetic agent of the amide type.[5] It inhibits nerve conduction in sensory and motor nerves primarily by interacting with voltage-gated sodium, potassium, and calcium channels located in the cell membrane and adjacent tissues.[6] Prior studies have shown that when used as an adjuvant in intraspinal and nerve blocks, nalbuphine offers longer-lasting and more effective postoperative analgesia. yet, there are no studies that verify its clinical impact on local infiltration at the surgical site. A short wound infiltration using a long-lasting local anaesthetic can yield analgesia for 4 to 8 hours. The postoperative analgesic effect can be extended when opioids, non-opioids, vasoconstrictors, alpha-2 agonists, and neostigmine are used in conjunction with various adjuvants.[7] The present study was conducted to compare analgesic efficacy of levobupivacaine alone and in combination with nalbuphine in the wound infiltration technique for lower abdominal surgeries under general anaesthesia.

MATERIALS AND METHODS

Study Design

This was a prospective, randomized, double-blinded comparative clinical study designed to evaluate the analgesic efficacy of levobupivacaine alone versus levobupivacaine combined with nalbuphine for wound infiltration in lower abdominal surgeries under general anaesthesia.

Study Population

The study was conducted on a total of 56 patients, aged between 18 and 60 years, of both genders, with ASA physical status Grades I, II, or III, who were scheduled for elective lower abdominal surgeries.

Study place

The study was conducted in the Department of Anaesthesia, Himalaya Medical College, Hospital, Patna, Bihar, India.

Study Duration

The study was conducted over a period of 12 months from February 2024 to January 2025.

Inclusion Criteria

- Age between 18 to 60 years
- ASA physical status I, II, or III
- Scheduled for elective lower abdominal surgery under general anaesthesia
- Provided written informed consent

Exclusion Criteria

- Known allergy or hypersensitivity to local anaesthetics or nalbuphine
- Patients on chronic opioid therapy
- Coagulopathy or bleeding disorders
- Severe hepatic, renal, or cardiac dysfunction
- Local infection at the surgical site
- Pregnant or lactating women
- Refusal to participate in the study

Ethical Considerations

Approval for the study was obtained from the Institutional Ethics Committee (IEC approval number to be inserted if available). Written informed consent was obtained from all patients before enrollment. The study adhered to the principles of the Declaration of Helsinki.

Study Procedure

Patients were randomly divided into two groups of 28 each using a computer-generated randomization table.

- Group I (Control group): Received wound infiltration with 18 mL of 0.25%

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levobupivacaine + 2 mL of 0.9% normal saline (total volume 20 mL)

- Group II (Study group): Received wound infiltration with 18 mL of 0.25% levobupivacaine + 2 mL nalbuphine (20 mg) (total volume 20 mL)

All patients underwent standard general anaesthesia. Wound infiltration was performed at the surgical incision site before skin closure, by the operating surgeon, using a 20 mL syringe in a uniform and standardized manner.

Surgical Technique

All procedures were elective lower abdominal surgeries (e.g., hernia repair, appendectomy, gynaecological surgeries) performed under general anaesthesia with standard intraoperative protocols.

Outcome Measures

Primary Outcome

Duration and quality of postoperative analgesia, assessed using the Numeric Rating Scale (NRS) for pain

Secondary Outcomes

Time to first rescue analgesia (when NRS ≥ 5 or on patient request)

Total number of rescue analgesic doses in the first 6 hours postoperatively

Hemodynamic parameters (HR, SBP, DBP) recorded:

At admission to PACU

At 30 minutes, 1 hour, 2 hours, 4 hours, and 6 hours postoperatively

Rescue Analgesia

Intravenous Paracetamol 1 g was administered either on demand or when NRS ≥ 5

Statistical Analysis

- Data were entered into Microsoft Excel and analyzed using SPSS version 21.0.
- Continuous variables were expressed as mean ± standard deviation (SD)
- Categorical variables were expressed as percentages or frequencies
- Intergroup comparisons were made using:
  - Student's t-test for continuous variables
  - Chi-square test for categorical variables

P value < 0.05 was considered statistically significant

RESULTS

Table 1: Demographic Data

Parameters	Group I	Group II	P value
Age (years)	48.2	48.5	0.25
Gender (M/F)	18/10	15/13	0.59
Weight (kg)	60.4	61.2	0.63
Height (cm)	154.2	156.4	0.17
ASA grade (1/2/3)	12/13/3	13/14/1	0.48
Duration of analgesia (hours)	4.5	9.1	0.01

Table 1 shows that mean age was 48.2 years in group I and 48.5 years in group II. There were 18 males and 10 females in group I and 15 males and 13 females in group II. The mean weight was 60.4 kgs in group I and 61.2 kgs in group II. The mean height was 154.2 cms in group I and 156.4 cms in group II. ASA grade (1/2/3) was seen in 12/13/3 in group I and 13/14/1 in group II. The mean duration of analgesia was 4.5 hours in group I and 9.1 hours in group II. The difference was non-significant (P> 0.05).

Table 2: Comparison of Hemodynamics

Parameters	Variables	Group I	Group II	P value
Pulse rate (PR)	Baseline	82.4	80.6	0.57
	Intraoperative	78.2	76.4	
	Postoperative	76.4	72.2	
SBP (mm Hg)	Baseline	124.2	120.4	0.68
	Intraoperative	128.6	118.2	
	Postoperative	126.4	116.6	
DBP (mm Hg)	Baseline	82.4	80.4	0.05
	Intraoperative	84.2	78.6	
	Postoperative	80.6	74.2	

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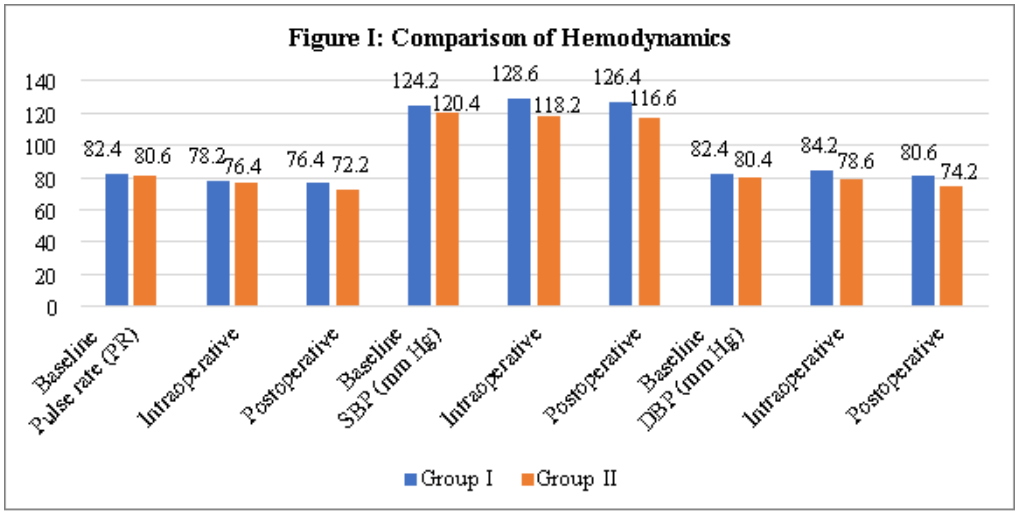

Table 2, figure I shows that in group I and group II, mean pulse rate (PR) at baseline was 82.4 and 80.6, at intraoperatively was 78.2 and 76.4 and postoperatively was 76.4 and 72.2 respectively. The mean SBP (mm Hg) at baseline was 124.2 and 120.4, intraoperatively was 128.6 and 118.2 and postoperatively was 126.4 and 116.6 respectively. The mean DBP (mm Hg) at baseline was 82.4 and 80.4, intraoperatively was 84.2 and 78.6 and postoperatively was 80.6 and 74.2 respectively. The difference was non-significant (P> 0.05).

Table 3: Comparison of Quality of Analgesia

Quality	Group I	Group II	P value
1	5	7	0.36
2	12	14	
3	6	7	
4	5	0	

Table 3 shows that quality of analgesia was 1 seen in 5 and 7, 2 in 12 and 14, 3 in 6 and 7 and 4 in 5 and 0 patients in group I and II respectively. The difference was non- significant (P> 0.05).

DISCUSSION

Reducing postoperative pain results in earlier patient mobilization, improved hemodynamic stability, the possibility of initiating oral intake on the first day after surgery, and enhanced satisfaction for patients and their families.[8] The gold standard method Enhanced Recovery After Surgery (ERAS) is designed to reduce stress, promote a speedy recovery, and facilitate a return to daily routine activities.[9] The ERAS protocols state that the removal and minimization of opioids can result in earlier mobilization, enhanced bowel motility, and the avoidance of nausea and vomiting. Methods of regional analgesia—including neuraxial blocks, peripheral nerve blocks, and wound infiltration—are essential elements of modern ERAS protocols.[10] For surgeries of shorter duration, pre-incisional infiltration with local anaesthetic agents can be planned, as it has the potential to change surgical anatomy and influence the length of analgesia, which is contingent on the action time of the local anaesthetic agents.[11] The present study was conducted to compare analgesic efficacy of levobupivacaine alone and in combination with nalbuphine in the wound infiltration technique for lower abdominal surgeries under general anaesthesia.

We found that mean age was 48,2 years in group I and 48.5 years in group II. There were 18 males and 10 females in group I and 15 males and 13 females in group II. The mean weight was 60.4 kgs in group I and 61.2 kgs in group II. The mean height was 154.2 cms in group I and 156.4 cms in group II. ASA grade (1/2/3) was seen in 12/13/3 in group I and 13/14/1 in group II. The mean duration of analgesia was 4.5 hours in group I and 9.1 hours in group II. Patel et al[12] compared the analgesic efficacy of local wound

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infiltration with levobupivacaine alone versus a mixture of levobupivacaine and nalbuphine for postoperative pain. Group L received 18 mL of 0.25% levobupivacaine plus 2 mL of 0.9% normal saline (total of 20 mL), while Group LN received 18 mL of 0.25% levobupivacaine plus 2 mL of nalbuphine (20 mg), also totaling 20 mL for wound infiltration. Demographic data, such as age, weight, height, ASA grade, and gender, were comparable between both groups (p-value >0.05). The total duration of analgesia in group LN was 9.20±0.79 hours, compared to 4.5±0.71 hours in group L (p-value <0.001), with better quality of analgesia in the adjuvant group and no reported side-effects, such as nausea, vomiting, bradycardia, hypotension, or sedation. Haemodynamic parameters showed that the Pulse Rate (PR) was 74.22±6.65 bpm, Systolic Blood Pressure (SBP) was 121±7.77 mmHg, and DBP was 74±7.05 mmHg, which were more stable in group LN at the 4-hour and 6-hour intervals of the postoperative period.

We found that in group I and group II, mean pulse rate (PR) at baseline was 82.4 and 80.6, at intraoperatively was 78.2 and 76.4 and postoperatively was 76.4 and 72.2 respectively. The mean SBP (mm Hg) at baseline was 124.2 and 120.4, intraoperatively was 128.6 and 118.2 and postoperatively was 126.4 and 116.6 respectively. The mean DBP (mm Hg) at baseline was 82.4 and 80.4, intraoperatively was 84.2 and 78.6 and postoperatively was 80.6 and 74.2 respectively. We found that quality of analgesia was 1 seen in 5 and 7, 2 in 12 and 14, 3 in 6 and 7 and 4 in 5 and 0 patients in group I and II respectively. Jyothi B et al[13] demonstrated that both clonidine and dexmedetomidine are effective adjuvants to levobupivacaine for wound infiltration; however, the combination of levobupivacaine with dexmedetomidine provided better postoperative analgesia, yielding excellent to good quality with minimal side-effects.

LIMITATIONS OF THE STUDY

- Small sample size (only 56 patients), which may limit generalizability
- Short postoperative follow-up duration (6 hours), which may miss later onset pain or complications
- Single-centre study, reducing external validity
- Subjective pain scoring (NRS) could introduce variability based on individual pain threshold
- Fixed dose of nalbuphine used without dose comparison
- Infiltration technique standardization was attempted, but minor variations by different surgeons may have influenced results

CONCLUSION

Authors found that in patients undergoing abdominal surgeries, the use of levobupivacaine combined with the adjuvant nalbuphine yielded good to excellent quality analgesia without any side effects. The addition of nalbuphine to levobupivacaine for wound infiltration in lower abdominal surgeries under general anesthesia effectively extends the duration of postoperative analgesia without compromising hemodynamic stability or increasing adverse effects. This combination appears to be a safe and effective strategy for improving postoperative pain management in such surgical procedures.

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