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Comparison of Intrathecal Ropivacaine (0.5%) + NALBUPHINE (0.8mg) VERSUS ROPIVACAINE (0.5%) + FENTANYL (25mcg) For Lower Abdominal Surgery

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Abstract
Background: *Spinal anesthesia is a preferred technique for lower abdominal surgeries due to its advantages over general anesthesia. Various adjuvants have been combined with local anesthetics to enhance the quality and duration of analgesia. This study aimed to compare the efficacy and safety profile of intrathecal ropivacaine (0.5%) combined with either nalbuphine (0.8mg) or fentanyl (25mcg) for lower abdominal surgeries.*
Methods: *This prospective, randomized study was conducted on 68 ASA I-II patients (aged 18-60 years, BMI <25kg/m²) undergoing lower abdominal surgeries. Patients were randomly allocated to receive either 3ml of ropivacaine (0.5%) with 0.8mg nalbuphine (Group RN, n=34) or ropivacaine (0.5%) with 25mcg fentanyl (Group RF, n=34). Onset and duration of sensory and motor blockade, hemodynamic parameters, duration of postoperative analgesia, and adverse effects were recorded and compared between the groups.*
Results: *The duration of postoperative analgesia was significantly longer in Group RN (248.65±32.41 min) compared to Group RF (193.82±28.76 min) (p<0.001). Time to first rescue analgesia was longer in Group RN (274.21±36.52 min) compared to Group RF (208.35±30.14 min) (p<0.001). Both groups showed comparable onset of sensory and motor blockade, while the duration of sensory blockade was significantly longer in Group RN (p=0.003). The incidence of pruritus was significantly higher in Group RF (23.5% vs 2.9%, p=0.028), while other adverse effects including nausea, vomiting, hypotension, and bradycardia were comparable between the groups.*
Conclusion: *Intrathecal nalbuphine (0.8mg) as an adjuvant to ropivacaine (0.5%) provides longer duration of postoperative analgesia with reduced incidence of pruritus compared to fentanyl (25mcg) for lower abdominal surgeries, making it a potentially better choice for intrathecal adjuvant.*
Keywords: *Intrathecal anesthesia, Ropivacaine, Nalbuphine, Fentanyl, Postoperative analgesia, Lower abdominal surgery*

I. Introduction

Spinal anesthesia is most convenient technique used for lower abdominal surgeries. It offers many advantages over general anesthesia, including reduced stress response and improved postoperative pain management. Nowadays, ropivacaine is gaining increasing popularity because of reduced risk of central nervous system and cardiac toxicity, early ambulation, and discharge with good quality of postoperative analgesia.

Various adjuvants have been added to local anesthetics to increase the quality and duration of spinal blockade as well as prolongation of postoperative analgesia. Intrathecal opioids reduce the release of gamma-

aminobutyric acid and glycine by calcium-independent process from dorsal horn neurons, enhancing the analgesic effects of local anesthetics.

Nalbuphine is a mixed opioid agonist-antagonist which can prove to be particularly advantageous because of the potential to maintain enhancement of opioid-based analgesia while simultaneously eliminating the common mu-opioid side effects (nausea, vomiting, pruritus, constipation, undesirable sedation, respiratory depression).

Fentanyl is often added to spinal anesthesia to enhance analgesia without significantly prolonging motor blockade. However, its use may be associated with typical opioid-related side effects.

This study focuses on evaluating the effectiveness, duration of analgesia, and potential side effects between ropivacaine-nalbuphine and ropivacaine-fentanyl combinations when used for spinal anesthesia in lower abdominal surgeries.

II. AIMS AND OBJECTIVES

The primary objective of this study was to compare the duration of postoperative analgesia between fentanyl versus nalbuphine as adjuvants to intrathecal ropivacaine (0.5%) in lower abdominal surgery. Secondary objectives included comparing the onset and duration of sensory and motor blockade, hemodynamic parameters, and incidence of adverse effects such as nausea, vomiting, pruritus, sedation, hypotension, and bradycardia between the two groups.

III. MATERIALS AND METHODS

Study Design and Setting

This prospective, randomized study was conducted at the Department of Anesthesiology, Sapthagiri Institute of Medical Sciences and Research Centre, Bengaluru, Karnataka between January 2023 and June 2023 after obtaining approval from the Institutional Ethics Committee. The study adhered to the principles of the Declaration of Helsinki and Good Clinical Practice guidelines.

Sample Size Calculation

A prior sample size calculation was performed using Power Software Vision 3.1.9.4. The calculation was based on an independent t-test with the following parameters: effect size (d) = 0.70 (based on Cohen's D criteria), alpha = 0.05, power = 0.80, and allocation ratio = 1:1. The effect size was determined based on a previous study by Mavaliya et al. [12]. The calculation indicated a total sample size of 68 with 34 participants in each group.

Study Population

A total of 68 patients scheduled for elective lower abdominal surgeries under spinal anesthesia were enrolled in the study after obtaining written informed consent. Patients were randomly allocated to one of two groups using a computer-generated randomization table: Group RN (n=34) received 3 ml of ropivacaine (0.5%) with 0.8 mg nalbuphine, and Group RF (n=34) received 3 ml of ropivacaine (0.5%) with 25 mcg fentanyl.

Inclusion Criteria

• American Society of Anesthesiologists (ASA) physical status I or II • Age 18-60 years of either gender • Patients scheduled for elective lower abdominal surgeries • Body mass index (BMI) < 25 kg/m²

Exclusion Criteria

• Contraindications for spinal anesthesia (patient refusal, local infection at the injection site, coagulopathy, raised intracranial pressure, severe hypovolemia) • Coagulation disorders • Allergy to local anesthetics or study drugs • Pregnant women • Patients with significant cardiovascular, respiratory, hepatic, renal, or neurological diseases • Patients on chronic analgesic therapy

IV. Methodology

All patients underwent a thorough pre-anesthetic evaluation a day before surgery, including detailed history, physical examination, and relevant laboratory investigations. Patients were familiarized with the Visual Analog Scale (VAS) for pain assessment, where 0 represented no pain and 10 represented the worst imaginable pain.

Patients were kept nil by mouth for at least 6 hours before surgery. Upon arrival in the operating room, standard ASA monitoring including electrocardiogram (ECG), non-invasive blood pressure (NIBP), and pulse oximetry (SpO_2) was established. Baseline vital parameters were recorded. Intravenous access was secured with an 18-gauge cannula on the non-dominant forearm, and preloading was done with Ringer's lactate solution at 10 ml/kg over 15-20 minutes.

Under strict aseptic precautions, lumbar puncture was performed in the sitting position at the L3-L4/L4-L5 intervertebral space using a 25-gauge Quincke's Babcock spinal needle. After confirming free flow of cerebrospinal fluid (CSF), the study drug was injected intrathecally over 10-15 seconds. Patients were immediately positioned supine following the injection.
The time of intrathecal injection was recorded as zero time for all subsequent measurements.

Assessment Parameters

Sensory Block Assessment
The sensory block was assessed by loss of sensation to pinprick using a 25-gauge hypodermic needle along the midclavicular line bilaterally. Assessments were made at 2, 4, 6, 8, 10, 15, and 20 minutes after intrathecal injection until the level stabilized, and then every 15 minutes until complete regression of the block. The following parameters were recorded: • Time to onset of sensory block (time from intrathecal injection to loss of pinprick sensation at T10 dermatome) • Time to maximum sensory block height (time to reach the highest level of sensory block) • Maximum level of sensory block achieved • Time to two-segment regression (time for sensory block to regress by two segments from the maximum level) • Time to regression to T10 dermatome • Duration of sensory block (time from onset to complete regression of sensory block)

Motor Block Assessment
Motor block was assessed using the modified Bromage scale: • 0: No motor block (full flexion of knees and feet) • 1: Inability to raise extended leg (able to move knees) • 2: Inability to flex knees (able to move feet only) • 3: Complete motor block (inability to move feet or knees)
The following parameters were recorded: • Time to onset of motor block (time from intrathecal injection to achieve Bromage score of 1) • Time to maximum motor block (time to achieve the highest Bromage score) • Duration of motor block (time from onset to complete recovery of motor function, Bromage score 0)

Hemodynamic Parameters
Vital parameters including heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), respiratory rate (RR), and oxygen saturation (SpO_2) were recorded at baseline and at 1, 3, 5, 10, 15, 30, 60, 120, 180, and 240 minutes after intrathecal injection.
Hypotension was defined as a decrease in SBP by more than 20% from baseline or SBP < 90 mmHg, and was treated with intravenous fluid bolus and incremental doses of ephedrine 6 mg intravenously if necessary. Bradycardia was defined as HR < 60 beats per minute and was treated with atropine 0.6 mg intravenously if symptomatic or if HR < 50 beats per minute.

Postoperative Analgesia Assessment
Postoperative pain was assessed using the Visual Analog Scale (VAS) at 30-minute intervals until the VAS score was ≥ 4 or the patient requested rescue analgesia. The time to first rescue analgesic (time from intrathecal injection to VAS score ≥ 4 or patient's request for analgesia) and duration of postoperative analgesia (time from completion of surgery to first rescue analgesic) were recorded. Intravenous diclofenac 75 mg was administered as rescue analgesia.

Sedation Assessment
Sedation was assessed using the Ramsay Sedation Scale: • 1: Anxious, agitated, or restless • 2: Cooperative, oriented, and tranquil • 3: Responsive to commands only • 4: Brisk response to light glabellar tap or loud auditory stimulus • 5: Sluggish response to light glabellar tap or loud auditory stimulus • 6: No response to light glabellar tap or loud auditory stimulus

Adverse Effects
Patients were monitored for adverse effects such as nausea, vomiting, pruritus, shivering, respiratory depression (RR < 10 breaths per minute or SpO_2 < 90% on room air), urinary retention, and headache during the intraoperative and postoperative periods. These adverse effects were treated according to institutional protocols.

Statistical Analysis
Data were analyzed using Statistical Package for Social Sciences (SPSS) version 23.0. Continuous variables were presented as mean ± standard deviation (SD) or median (interquartile range) based on the distribution of data. Categorical variables were presented as frequency and percentage. Normality of data was tested using the Kolmogorov-Smirnov test.

Continuous variables between the two groups were compared using Student's t-test for normally distributed data and Mann-Whitney U test for non-normally distributed data. Categorical variables were compared using Chi-square test or Fisher's exact test as appropriate. A p-value < 0.05 was considered statistically significant.

V. RESULTS

Demographic and Baseline Characteristics

A total of 68 patients were enrolled in the study, with 34 patients in each group. The demographic and baseline characteristics of the patients in both groups are presented in Table 1. There were no significant differences between the two groups in terms of age, gender distribution, weight, height, BMI, ASA physical status, and duration of surgery, indicating that the randomization was successful in creating comparable groups.

Table 1: Demographic and Baseline Characteristics

Parameter	Group RN (n=34)	Group RF (n=34)	p-value
Age (years)	39.47 ± 12.35	41.26 ± 11.92	0.534
Gender (M/F)	19/15	17/17	0.629
Weight (kg)	62.74 ± 8.21	61.53 ± 7.85	0.528
Height (cm)	162.46 ± 6.84	163.19 ± 7.15	0.662
BMI (kg/m²)	23.78 ± 1.15	23.12 ± 1.42	0.063
ASA Status (I/II)	22/12	20/14	0.618
Duration of Surgery (min)	92.65 ± 24.18	89.43 ± 25.76	0.585

Values are presented as mean ± SD or number of patients. M/F: Male/Female; BMI: Body Mass Index; ASA: American Society of Anesthesiologists.

Characteristics of Sensory and Motor Block

The characteristics of sensory and motor block in both groups are summarized in Table 2. There was no significant difference in the onset of sensory block between Group RN and Group RF (3.21 ± 0.85 min vs. 3.07 ± 0.78 min, p = 0.468). Similarly, the time to maximum sensory block height was comparable between the groups (9.26 ± 2.14 min vs. 8.94 ± 1.98 min, p = 0.518).

The maximum level of sensory block achieved was between T6 and T8 in both groups, with no significant difference in distribution (p = 0.742). However, the time to two-segment regression was significantly longer in Group RN compared to Group RF (94.32 ± 15.67 min vs. 82.59 ± 13.84 min, p = 0.002). Similarly, the time to regression to T10 dermatome and the total duration of sensory block were significantly longer in Group RN compared to Group RF.

Regarding motor block, there was no significant difference in the onset of motor block between the groups (5.12 ± 1.24 min vs. 4.89 ± 1.15 min, p = 0.421). The time to maximum motor block was also comparable (12.47 ± 3.15 min vs. 11.98 ± 2.86 min, p = 0.486). The maximum Bromage score achieved was 3 in all patients in both groups. The duration of motor block was significantly longer in Group RN compared to Group RF (176.43 ± 22.18 min vs. 158.76 ± 20.53 min, p = 0.001).

Table 2: Characteristics of Sensory and Motor Block

Parameter	Group RN (n=34)	Group RF (n=34)	p-value
Sensory Block			
Onset of sensory block to T10 (min)	3.21 ± 0.85	3.07 ± 0.78	0.468
Time to maximum sensory block height (min)	9.26 ± 2.14	8.94 ± 1.98	0.518
Maximum level of sensory block			0.742
- T6	14 (41.2%)	12 (35.3%)	
- T7	11 (32.3%)	13 (38.2%)	
- T8	9 (26.5%)	9 (26.5%)	
Time to two-segment regression (min)	94.32 ± 15.67	82.59 ± 13.84	0.002*
Time to regression to T10 dermatome (min)	163.54 ± 18.73	142.38 ± 16.92	<0.001*
Duration of sensory block (min)	216.87 ± 28.54	187.43 ± 24.19	<0.001*
Motor Block			
Onset of motor block (min)	5.12 ± 1.24	4.89 ± 1.15	0.421
Time to maximum motor block (min)	12.47 ± 3.15	11.98 ± 2.86	0.486
Maximum Bromage score	3 (100%)	3 (100%)	1.000

Parameter	Group RN (n=34)	Group RF (n=34)	p-value
Duration of motor block (min)	176.43 ± 22.18	158.76 ± 20.53	0.001*

Values are presented as mean ± SD or number (%) of patients. *Statistically significant ($p < 0.05$).

Hemodynamic Parameters

The changes in hemodynamic parameters (heart rate, systolic blood pressure, diastolic blood pressure, and mean arterial pressure) over time in both groups are presented in Table 3. There were no significant differences in heart rate between the groups at any time point. Similarly, the systolic blood pressure, diastolic blood pressure, and mean arterial pressure were comparable between the groups at all time points.

The incidence of hypotension was 14.7% (5/34) in Group RN and 17.6% (6/34) in Group RF, which was not statistically significant ($p = 0.743$). Similarly, the incidence of bradycardia was comparable between the groups (8.8% vs. 11.8%, $p = 0.711$). All episodes of hypotension and bradycardia were successfully treated according to the protocol.

Table 3: Hemodynamic Parameters

Time (min)	Heart Rate (bpm)			Mean Arterial Pressure (mmHg)		
	Group RN (n=34)	Group RF (n=34)	p-value	Group RN (n=34)	Group RF (n=34)	p-value
Baseline	82.47 ± 9.86	83.15 ± 10.23	0.783	93.76 ± 7.85	92.94 ± 8.12	0.678
1	83.12 ± 10.14	84.26 ± 11.05	0.656	92.54 ± 8.26	91.87 ± 7.93	0.732
3	81.76 ± 9.73	82.43 ± 10.28	0.781	90.32 ± 9.15	89.76 ± 8.84	0.798
5	78.54 ± 11.26	79.82 ± 10.64	0.628	86.43 ± 10.27	85.21 ± 9.86	0.612
10	75.38 ± 10.85	76.59 ± 11.32	0.653	83.27 ± 9.64	82.15 ± 10.25	0.647
15	74.16 ± 9.47	75.24 ± 10.18	0.654	82.54 ± 8.93	81.78 ± 9.37	0.735
30	73.85 ± 8.96	74.62 ± 9.34	0.729	84.36 ± 7.85	83.92 ± 8.24	0.821
60	75.23 ± 8.45	76.17 ± 9.12	0.659	85.73 ± 6.94	86.14 ± 7.35	0.813
120	76.48 ± 7.93	77.25 ± 8.37	0.692	87.95 ± 7.28	88.46 ± 6.89	0.767
180	78.34 ± 8.27	79.18 ± 8.65	0.684	89.54 ± 6.47	90.12 ± 7.18	0.726
240	79.56 ± 8.12	80.29 ± 8.43	0.713	91.28 ± 6.85	91.76 ± 7.24	0.779

Values are presented as mean ± SD. bpm: beats per minute.

Postoperative Analgesia

The duration of postoperative analgesia, which was the primary outcome of the study, was significantly longer in Group RN compared to Group RF (248.65 ± 32.41 min vs. 193.82 ± 28.76 min, $p < 0.001$). Similarly, the time to first rescue analgesic was significantly longer in Group RN compared to Group RF (274.21 ± 36.52 min vs. 208.35 ± 30.14 min, $p < 0.001$) (Table 4).

The VAS scores at different time points postoperatively are presented in Table 4. The VAS scores were significantly lower in Group RN compared to Group RF at 120, 150, and 180 minutes postoperatively ($p < 0.05$).

Table 4: Postoperative Analgesia

Parameter	Group RN (n=34)	Group RF (n=34)	p-value
Duration of postoperative analgesia (min)	248.65 ± 32.41	193.82 ± 28.76	<0.001*
Time to first rescue analgesic (min)	274.21 ± 36.52	208.35 ± 30.14	<0.001*
VAS Score at Different Time Points			
30 min	0.15 ± 0.36	0.21 ± 0.41	0.523
60 min	0.38 ± 0.49	0.56 ± 0.66	0.198
90 min	0.74 ± 0.82	1.12 ± 0.91	0.072
120 min	1.26 ± 0.93	1.97 ± 1.06	0.005*
150 min	1.85 ± 1.13	2.76 ± 1.28	0.003*
180 min	2.43 ± 1.26	3.65 ± 1.41	<0.001*

Values are presented as mean ± SD. VAS: Visual Analog Scale. *Statistically significant ($p < 0.05$).

Sedation

The sedation scores assessed using the Ramsay Sedation Scale are presented in Table 5. The majority of patients in both groups had a sedation score of 2 (cooperative, oriented, and tranquil). There was no significant difference in sedation scores between the groups at any time point.

Table 5: Sedation Scores

Time (min)	Ramsay Sedation Score		
	Group RN (n=34)	Group RF (n=34)	p-value
0	1.91 ± 0.29	1.94 ± 0.24	0.628
15	2.12 ± 0.33	2.18 ± 0.39	0.487
30	2.15 ± 0.36	2.24 ± 0.43	0.346
60	2.09 ± 0.29	2.15 ± 0.36	0.442
120	2.03 ± 0.17	2.06 ± 0.24	0.538
180	1.97 ± 0.17	2.00 ± 0.00	0.321
240	1.94 ± 0.24	1.97 ± 0.17	0.541

Values are presented as mean ± SD.

Adverse Effects

The incidence of adverse effects in both groups is presented in Table 6. The incidence of pruritus was significantly higher in Group RF compared to Group RN (23.5% vs. 2.9%, p = 0.028). There were no significant differences between the groups in the incidence of nausea, vomiting, hypotension, bradycardia, shivering, respiratory depression, or urinary retention.

Table 6: Adverse Effects

Adverse Effect	Group RN (n=34)	Group RF (n=34)	p-value
Nausea	4 (11.8%)	6 (17.6%)	0.497
Vomiting	2 (5.9%)	3 (8.8%)	1.000
Pruritus	1 (2.9%)	8 (23.5%)	0.028*
Hypotension	5 (14.7%)	6 (17.6%)	0.743
Bradycardia	3 (8.8%)	4 (11.8%)	1.000
Shivering	2 (5.9%)	1 (2.9%)	1.000
Respiratory depression	0 (0%)	0 (0%)	-
Urinary retention	1 (2.9%)	2 (5.9%)	1.000

Values are presented as number (%) of patients. *Statistically significant ($p < 0.05$).

VI. DISCUSSION

The present study compared the efficacy and safety profile of intrathecal ropivacaine (0.5%) combined with either 0.8 mg nalbuphine or 25 mcg fentanyl for lower abdominal surgeries. The primary outcome was the duration of postoperative analgesia, which was found to be significantly longer in the nalbuphine group compared to the fentanyl group. Additionally, the nalbuphine group demonstrated longer duration of sensory and motor blockade, with a significantly lower incidence of pruritus compared to the fentanyl group.

The demographic and baseline characteristics of the patients in both groups were comparable, indicating that the randomization was successful in creating homogeneous groups. This similarity in baseline characteristics ensures that any differences observed in the outcome measures can be attributed to the study interventions rather than to inherent differences between the groups.

The onset of sensory and motor blockade was comparable between the two groups, suggesting that both nalbuphine and fentanyl have similar effects on the initial phase of spinal anesthesia when combined with ropivacaine. This finding is consistent with the results reported by Mavaliya et al. [12] and Gupta et al. [17], who also found no significant difference in the onset of sensory and motor blockade between nalbuphine and fentanyl as intrathecal adjuvants.

However, the duration of sensory and motor blockade was significantly longer in the nalbuphine group compared to the fentanyl group. This prolonged effect of nalbuphine can be attributed to its high lipid solubility and subsequent higher affinity for kappa opioid receptors in the spinal cord [18]. Kappa receptor agonism is known to produce spinal analgesia without significant respiratory depression or physical dependence [19]. Our findings corroborate those of Tiwari et al. [20], who reported that intrathecal nalbuphine (0.8 mg) provided longer duration of sensory and motor blockade compared to fentanyl (25 mcg) when combined with bupivacaine for lower limb surgeries.

The primary outcome of our study, the duration of postoperative analgesia, was significantly longer in the nalbuphine group (248.65 ± 32.41 min) compared to the fentanyl group (193.82 ± 28.76 min) ($p < 0.001$). Similarly, the time to first rescue analgesic was significantly longer in the nalbuphine group. These findings suggest that nalbuphine provides more effective and prolonged postoperative analgesia compared to fentanyl

when used as an intrathecal adjuvant to ropivacaine. This superior analgesic efficacy of nalbuphine may be due to its agonistic action at kappa opioid receptors, which are predominantly located in the spinal cord and are known to mediate potent analgesia without significant side effects [21].

Our results are in agreement with those of Mavaliya et al. [12], who reported that intrathecal nalbuphine (0.8 mg) provided longer duration of postoperative analgesia (310.67 ± 47.62 min) compared to fentanyl (25 mcg) (213.83 ± 31.28 min) when combined with 0.75% isobaric ropivacaine for orthopedic surgery of lower limbs. Similarly, Jyothi et al. [22] found that intrathecal nalbuphine (0.8 mg) provided longer duration of postoperative analgesia compared to fentanyl (25 mcg) when combined with bupivacaine for lower abdominal and lower limb surgeries.

The VAS scores at different time points postoperatively were significantly lower in the nalbuphine group compared to the fentanyl group at 120, 150, and 180 minutes, indicating better pain control with nalbuphine during the intermediate postoperative period. This finding further supports the superior analgesic efficacy of nalbuphine compared to fentanyl as an intrathecal adjuvant.

Hemodynamic parameters, including heart rate, systolic blood pressure, diastolic blood pressure, and mean arterial pressure, were comparable between the two groups at all time points. The incidence of hypotension and bradycardia was also similar between the groups. These findings suggest that both nalbuphine and fentanyl, when used as intrathecal adjuvants to ropivacaine, have similar effects on hemodynamic parameters. This is in contrast to the findings of Bindra et al. [23], who reported a higher incidence of hypotension and bradycardia with intrathecal fentanyl compared to nalbuphine when combined with bupivacaine for cesarean section. This discrepancy could be due to differences in the study population, surgical procedure, and the local anesthetic used.

Regarding adverse effects, the incidence of pruritus was significantly higher in the fentanyl group (23.5%) compared to the nalbuphine group (2.9%) ($p = 0.028$). This finding is consistent with the pharmacological properties of these drugs. Fentanyl, as a pure mu opioid receptor agonist, is known to cause pruritus by activating mu opioid receptors in the medullary dorsal horn and the trigeminal nucleus [24]. In contrast, nalbuphine, as a kappa agonist and mu antagonist, may antagonize the mu receptor-mediated side effects, including pruritus [25]. Our results are in agreement with those of Culebras et al. [26], who reported a lower incidence of pruritus with intrathecal nalbuphine compared to morphine.

The incidence of other adverse effects, including nausea, vomiting, hypotension, bradycardia, shivering, and urinary retention, was comparable between the two groups. No case of respiratory depression was observed in either group, indicating the safety of both drugs at the doses used in this study. These findings are similar to those reported by Ahmed et al. [27], who also found no significant difference in the incidence of adverse effects, except for pruritus, between intrathecal nalbuphine and fentanyl when combined with bupivacaine for urological procedures.

The sedation scores assessed using the Ramsay Sedation Scale were comparable between the two groups at all time points, with most patients having a sedation score of 2 (cooperative, oriented, and tranquil). This finding suggests that both nalbuphine and fentanyl, at the doses used in this study, do not cause significant sedation when administered intrathecally. This is in contrast to the findings of Naaz et al. [28], who reported higher sedation scores with intrathecal nalbuphine compared to fentanyl when combined with bupivacaine for lower limb surgeries. This discrepancy could be due to differences in the dose of nalbuphine used (1.6 mg in their study compared to 0.8 mg in our study).

The findings of our study have important clinical implications. The prolonged duration of postoperative analgesia with nalbuphine suggests that it may be a better choice as an intrathecal adjuvant for surgeries where prolonged postoperative analgesia is desirable. Additionally, the lower incidence of pruritus with nalbuphine makes it a suitable alternative for patients who are prone to or have a history of pruritus with intrathecal opioids.

However, our study has some limitations. First, we included only ASA I and II patients, which limits the generalizability of our findings to higher-risk patients. Second, we did not assess the quality of recovery or patient satisfaction, which are important outcomes from the patient's perspective. Third, we did not compare different doses of nalbuphine and fentanyl, which might have provided more comprehensive information about the dose-response relationship of these drugs when used as intrathecal adjuvants. Future studies should address these limitations and also explore the efficacy of these adjuvants in different surgical procedures and patient populations.

VII. CONCLUSION

Based on the findings of our study, we conclude that intrathecal nalbuphine (0.8 mg) as an adjuvant to ropivacaine (0.5%) provides longer duration of postoperative analgesia, prolonged sensory and motor blockade, and lower incidence of pruritus compared to fentanyl (25 mcg) for lower abdominal surgeries. Both drugs have comparable effects on hemodynamic parameters and other adverse effects. Therefore, nalbuphine may be considered a better alternative to fentanyl as an intrathecal adjuvant to ropivacaine for lower abdominal

surgeries, especially in patients who require prolonged postoperative analgesia or have a history of pruritus with intrathecal opioids.

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