Original Article

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Anaesthesia Section

Comparison of Epidural Infusion of 0.1% Ropivacaine and 0.2% Ropivacaine for Postoperative Analgesia using Elastomeric Pump in Abdominal Hysterectomies: A Randomised Controlled Trial

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ABSTRACT

Introduction: Epidural analgesia is a common and one of the standard modes of postoperative analgesia for surgeries involving the lower abdomen and lower extremities. The duration of action of Ropivacaine is longer and is favoured for its sensory block with minimal motor impairment, yet the optimal concentration for analgesia and adverse effects remains unclear.

Aim: To compare the efficacy and safety of 0.1% Ropivacaine with Fentanyl 2 mcg/mL versus 0.2% Ropivacaine with Fentanyl 2 mcg/mL for postoperative pain relief using an elastomeric pump in abdominal hysterectomy patients.

Materials and Methods: This was a double-blinded, randomised controlled trial conducted at the Department of Anaesthesia, SRM Medical College Hospital and Research Institute, Kattankulathur, Tamil Nadu, India, from August 2023 to December 2024. Patients who were undergoing abdominal hysterectomy as elective surgeries with American Society of Anaesthesiologists (ASA) physical status grading as I, II, or III from 35 years to 65 years were included. The study was conducted on 100 patients, who were divided into two groups: Group R1 (0.1% Ropivacaine with 2 mcg/mL Fentanyl) and Group R2 (0.2% Ropivacaine with 2 mcg/mL Fentanyl) as a continuous epidural infusion at 5 mL/hour via elastomeric pump for 48 hours postoperatively. Visual Analogue Scale (VAS) was used to assess the intensity of pain at rest, on movement and while coughing at regular intervals. Motor blockade was evaluated with the modified Bromage scale. Haemodynamic parameters were monitored, and rescue analgesia was provided with intravenous (i.v.) Paracetamol or Tramadol as required. An Unpaired t-test was used to compare continuous variables.

Results: Between groups R1 and R2, demographic characteristics such as age, weight, height, Body Mass Index (BMI), baseline pulse rate, baseline Systolic Blood Pressure (SBP), and baseline Diastolic Blood Pressure (DBP) were comparable. At 30 min, 45 min and 1 hour, the heart rate was lower in group R2 (p-value <0.0001). At 15 min and 12 hours, group R2 had a lower Mean Arterial Pressure (MAP) (p-value=0.0005, p-value=0.0089) in contrast to group R1. VAS scores were comparable between the two groups, except at 24 hours, which was lower in group R2 (p-value=0.0232). Group R2 had significantly lower VAS scores during movement and cough. Significant motor blockade was observed in group R2 (p-value <0.05). Group R2 required fewer rescue analgesics (p-value <0.05).

Conclusion: Ropivacaine (0.1%) provided adequate pain relief at rest. While on movement and coughing, 0.2% Ropivacaine had lower VAS scores with comparable haemodynamic stability between both groups. Motor blockade was more with 0.2% Ropivacaine.

Keywords: Adjuvants, Fentanyl, Haemodynamic stability, Hyperbaric bupivacaine, Spinal anaesthesia

INTRODUCTION

In Enhanced Recovery After Surgery (ERAS) protocols, postoperative pain therapy plays a major role, particularly in major abdominal procedures such as hysterectomy. Abdominal hysterectomy, a common gynaecological surgery, is often associated with significant postoperative pain that can impede early mobilisation, prolong hospital stay, and increase the risk of complications such as deep vein thrombosis [1]. Optimal pain control not only improves patient comfort but also facilitates early ambulation, reduces morbidity, and accelerates overall recovery [2].

Analgesia through epidural infusion remains the most effective modality in managing postoperative pain following abdominal surgeries. By providing segmental analgesia, epidural infusions can significantly attenuate the surgical stress response, minimise opioid consumption by which in turn decreases the incidence of opioid-related adverse effects which including vomiting, nausea, respiratory depression and pruritus. For epidural analgesia, the drug Ropivacaine has gained popularity due to its favourable pharmacological profile. As a local anaesthetic and a long-acting amide, Ropivacaine has a lower risk for motor block and systemic toxicity compared to Bupivacaine, making it particularly suitable for postoperative analgesia where early mobilisation is desired. [3,4] Ropivacaine provides equivalent analgesia and is as effective as Bupivacaine with lesser motor blockade [5,6].

In epidural infusions, the concentration of Ropivacaine used is a critical determinant of the quality of pain relief and the occurrence of side effects. Lower concentrations (such as 0.1%) are often preferred to minimise motor blockade [7] and facilitate early mobilisation, whereas higher concentrations (such as 0.2%) may provide more profound analgesia but at the expense of increased motor block [8]. The addition of adjuvants like Fentanyl can enhance the analgesic efficacy of lower concentrations of local anaesthetics [9,10], potentially allowing for a reduction in total anaesthetic dose while maintaining adequate pain relief.

Despite the widespread use of Ropivacaine for epidural analgesia, there is limited consensus regarding the optimal concentration for analgesia following abdominal hysterectomy [11]. Furthermore, the use of elastomeric infusion pumps offers the advantage of consistent drug delivery and improved patient mobility compared to traditional infusion systems. During literature search, 0.1% Ropivacaine needed more top-ups [12], 0.1% and 0.2% Ropivacaine had comparable VAS scores [13], 0.1% Ropivacaine provided adequate labour analgesia and postoperative pain relief along with Fentanyl [7,10,14]. This study aimed to compare the efficacy and safety of continuous epidural infusion of 0.1% and 0.2% Ropivacaine, both combined with Fentanyl, administered via elastomeric pump in patients undergoing abdominal hysterectomy for postoperative analgesia. The primary objective was to compare the VAS scores at rest, movement, and while coughing between the two groups and the secondary objectives were to compare the need for rescue analgesia, haemodynamic changes and motor blockade.

MATERIALS AND METHODS

This was a double-blinded, randomised controlled trial conducted at the Department of Anaesthesia, SRM Medical College Hospital and Research Institute, Kattankulathur, Tamil Nadu, India, from August 2023 to December 2024. The Institutional Ethics Committee approved our study (SRMIEC-ST0823-698) and registered it with the Clinical Trial Registry of India (CTRI/2024/05/067730).

Inclusion criteria: Female patients aged 35 to 65 years, who were assessed using ASA physical status grading as I, II, or III, scheduled for elective abdominal hysterectomy under general anaesthesia with epidural anaesthesia, were considered eligible for inclusion. Additional inclusion criteria included a weight range of 50 to 80 kg and a height range of 145 to 165 cm.

Exclusion criteria: Patients were excluded if they refused participation, had known allergies to Ropivacaine or Fentanyl, local infection at the epidural site, coagulopathy, hypovolemia, were on anticoagulant therapy or unco-operative.

Sample size calculation: The sample size was calculated to be 100 using the trial done by Bhasin S et al., [8], and they conducted a pilot study with 10 patients in each group and had an effect size of 0.657. And in this study, the same effect size and the following values α=1.96, β=0.84, r=1 were used. The sample size calculation was,

n= (1+r / r) (Z1 - α/2 + Z1 - β)2 / d2 + Z12- α/2 / 2(1+r).

n= (1+1/1) (1.96+0.84)2 / (0.6)2 + (1.96)2 / 2(1+1)

n= (2/1) (2.8)2 / 0.36 + 3.84 / 2(2)

n= 2 x 7.84/0.36 + 0.96

n= 2 x 21.7777 + 0.96

n= 45,

n1=50 (considering dropouts - 5 in each group, 45+5=50)

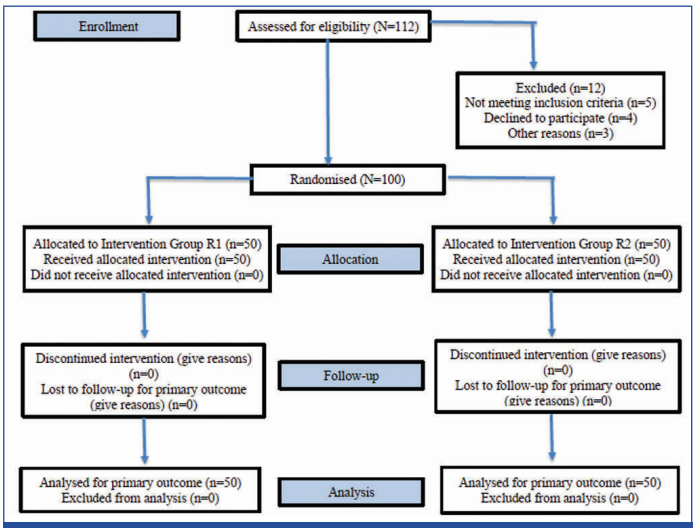
n2= 50

Total sample size, N=100

Study Procedure

All eligible females who satisfied our inclusion criteria were evaluated on the prior day to surgery and were counselled about the need for postoperative analgesia, the study protocol, and anaesthetic technique. Patients were educated about the Visual Analogue Scale (VAS) for pain assessment and the Modified Bromage Scale for assessing motor blockade. Informed and written consent in the local language was acquired from all participants. The participants were given Tab. Alprazolam 0.25 mg on the night before and two hours before surgery as premedication. As per Institutional protocols, patients were advised to have nil per oral for 8 hours for solid foods. Patients in both groups were shifted onto the operating table and baseline monitors, i.e., non invasive blood pressure, pulse oximetry and ECG leads were connected to the patient and baseline values such as blood pressure, heart rate and Oxygen Saturation (SpO_2) were recorded. An i.v. access was established using an 18G or 20G venflon. In both groups, general anaesthesia + epidural anaesthesia was performed by an anaesthesiologist according to hospital protocols. Epidural catheterisation was done using a 16G or 18G Tuohy's needle at L2-L3 or L3-L4 space using the loss-of-resistance technique.

Following surgery, patients were transferred to the Obstetric Intensive Care Unit (ICU), where continuous epidural infusion was initiated according to group allocation. A computer-generated random number was used for randomisation and group allocation, which was done before the study began. The SNOSE (Sequentially Numbered, Opaque, Sealed Envelopes) technique was used for double blinding and for concealing allocation. The investigator and the patients were blinded. Each patient received a unique study number, and group assignments were revealed only at the time of intervention by the attending doctor in the Obstetric ICU. The group allocation was done by the doctor residing in the obstetric ICU. Out of 112 patients assessed, 100 patients were included in the study, who were divided into two groups [Table/Fig-1] shows the flowchart as per updated Consolidated Standards of Reporting Trials (CONSORT) 2025 [15].



[Table/Fig-1]: CONSORT flowchart.

Participants were assigned to one of two groups:

- Group R1 (n=50): The patients here received 0.1% Ropivacaine with Fentanyl 2 mcg/mL as a continuous epidural infusion at 5 mL/hour via an elastomeric infusion pump [16].
- Group R2 (n=50): The patients here received 0.2% Ropivacaine with Fentanyl 2 mcg/mL as a continuous epidural infusion at 5 mL/hour via an elastomeric infusion pump [16].

The study drug was prepared and loaded into a Continuous Basal Infusion (CBI) -type disposable TUORen elastomeric pump, later connected to the epidural catheter, and the rate was set at 5 mL/hour, which was delivered continuously for 48 hours postoperatively. Visual Analogue Scale (VAS) was used for assessing pain at rest, during movement, and while coughing, every four hours for 48 hours. Inj. Paracetamol 1g and inj. Tramadol 100 mg was given as rescue analgesia. Whenever the patient complained of a VAS score more than 3 but less than 5, inj. Paracetamol 1 g i.v. was given, and for a VAS score of more than 6, inj. Tramadol 100 mg i.v. was given as rescue analgesia along with inj. Ondansetron 4mg i.v. Motor blockade was evaluated using the modified Bromage scale. Pain scores and patient's vitals were recorded at 15, 30, 45, and 60 minutes postoperatively, and subsequently every four hours. Hypotension was managed with intravenous fluids or Ephedrine 6 mg as required, as per Institutional protocols for managing hypotension.

The primary outcome was to compare the VAS scores at rest, movement, and while coughing between the two groups, and the secondary outcome was to compare the need for rescue analgesia, haemodynamic changes and motor blockade.

STATISTICAL ANALYSIS

Age, weight, height, BMI, Mean VAS score, Baseline Heart rate, baseline SBP, baseline DBP, baseline MAP, baseline SpO_2, postoperative heart rate, postoperative MAP, VAS score, motor blockade, and total number of rescue analgesia needed were expressed as Mean and Standard Deviation (SD). An Unpaired (independent samples) t-test was used to compare the continuous variables. IBM-SPSS software version 21.0 (IBM-SPSS Science Inc., Chicago, IL) was used for statistical analysis. Unpaired t-test (two-tailed) was used to calculate the significance, with p-values <0.05.

RESULTS

The demographic parameters such as age, height, weight, BMI, baseline heart rate, baseline mean arterial pressure and baseline SpO2 showed no statistically significant differences, which is explained in [Table/Fig-2]. Group R2 had considerably lower VAS scores at rest at 15 minutes of infusion, as shown in [Table/Fig-3]. No statistical significance was seen from 30 minutes to 12 hours (p-value>0.005). At 24 hours, group R2 had lower VAS, and after that, the VAS scores were comparable. Hence, group R1 and group R2 provided adequate analgesia at rest. On movement, group R2 had lower VAS scores from 15 minutes to 32 hours (p-value <0.05 at all times) [Table/Fig-4]. After 32 hours, both groups were comparable. While coughing, VAS scores were lower in group R2 from 15 minutes until 40 hours (p-value <0.05 at all times), after which both groups were comparable [Table/Fig-5,6] shows the doses and number of rescue analgesics given during the postoperative period. Group R1 needed a higher mean dose of Paracetamol and Tramadol. Also, group R1 needed a larger number of analgesic doses compared to R2. Group R2 showed lower heart rate in the early postoperative period from 30 to 60 minutes, but had comparable heart rates after 4 hours [Table/Fig-7]. Similarly, group R2 had lower MAP at 15 minutes and at 12 hours, as shown in [Table/Fig-8]. This indicates that overall haemodynamics remained stable in both groups throughout the 48-hours study period. The intensity of motor blockade between the groups are shown in [Table/Fig-9]. In the initial period, motor block

Demographic parameters	Group R1	Group R2	p-value*
Age (years)	46.24±7.38	43.62±4.99	0.1044
Weight (kg)	66±7.68	63.5±9.53	0.149
Height (cm)	154.72±5.79	155.54±5.21	0.459
BMI	27.72±4.09	26.25±4.45	0.1142
Baseline SBP (mmHg)	129.82±5.92	129.56±5.86	0.8259
Baseline DBP (mmHg)	85.58±3.35	85.08±3.02	0.4352
Baseline HR (beats per minute)	77.89±7.95	79.82±8.57	0.2390
Baseline SpO_2 (%)	97.38±1.14	97.5±1.24	0.2390

[Table/Fig-2]: Demographic parameters.
*p-value significant

VAS	Group R1	Group R2	p-value
15 min	1.82±0.39	1.52± 0.50	0.0012*
30 min	1.86 ±0.35	1.72± 0.45	0.0873
45 min	1.9±0.30	1.82±0.38	0.2534
1 hour	1.94 ±0.24	1.88±0.32	0.2915
4 hours	2.02±0.25	1.96±0.2	0.1882
8 hours	2.2±0.4	2.08 ± 0.34	0.1092
12 hours	2.52±0.5	2.36±0.48	0.1058
16 hours	2.84±0.69	2.62±0.49	0.0691
20 hours	3.14±0.94	2.9±0.6	0.1313
24 hours	3.36± 1.21	2.92±0.60	0.0232*
28 hours	3.22± 0.78	3±0.97	0.2143
32 hours	3.10±1.104	2.86±0 .78	0.2105
36 hours	2.9±0. .91	2.74±0.75	0.3396
40 hours	3±0.76	2.8 ± 0.64	0.1578
44 hours	2.94 ±0.89	2.76±0.69	0.2604
48 hours	2.6± 0.67	2.46±0.58	0.2663

[Table/Fig-3]: Comparison of pain at rest during the postoperative period.
*p-value significant

VAS Movement	Group R1	Group R2	p-value
15 min	2.76±0.43	2.24±.43	<0.0001*
30 min	2.84±0.37	2.54±0.503	0.001*
45 min	2.88±0.33	2.58±0.5	0.0006*
1 hour	3.08±0.27	2.9±0.303	0.0024*
4 hours	3.22±0.42	3.04 ± 0.198	0.0073*
8 hours	3.58±0.5	3.38±0.49	0.0459*
12 hours	3.88±0.33	3.62±0.49	0.0024*
16 hours	4.38±0.49	4.1 ± 0.3	0.0008*
20 hours	4.74±0.44	4.5±0.505	0.0131*
24 hours	4.86±0.35	4.68±0.47	0.0323*
28 hours	5.6±0.49	5.48 ± 0.5	0.0007*
32 hours	5.8±0.404	5.62 ± 0.49	0.0478*
36 hours	6.56±0.50	6.36 ± 0.53	0.0551
40 hours	6.88±0.33	6.76±0.43	0.1207
44 hours	7.3±0.46	7.16±0.47	0.1355
48 hours	7.58±0.5	7.4 ±0.53	0.0838

[Table/Fig-4]: Comparison of pain on movement during the postoperative period.
*p-value significant

VAS Cough	Group R1	Group R2	p-value
15 min	3.66±0.48	3.26±0.44	<0.0001*
30 min	3.8±0.4	3.32±0.47	<0.0001*
45 min	4.24±0.48	3.9±0.3	<0.0001*
1 hour	4.64±0.48	4.18±0.39	0.0079*
4 hours	4.52±0.5	4.42±0.5	0.0271*
8 hours	4.96±0.198	4.76±0.43	0.0036*
12 hours	5.24±0.43	4.82±0.39	<0.0001*
16 hours	5.34±0.48	5.02±0.14	<0.0001*
20 hours	5.6±0.49	5.34±0.48	0.0086*
24 hours	5.84±0.37	5.48±0.5	0.0001*
28 hours	6.24±0.43	6.08±0.27	0.0281*
32 hours	6.74±0.44	6.34±0.48	<0.0001*
36 hours	7.3±0.46	7.06±0.24	0.0015*
40 hours	7.74±0.44	7.48±0.5	0.0069*
44 hours	7.86±0.35	7.76±0.43	0.2052
48 hours	7.94±0.42	7.84±0.51	0.2871

[Table/Fig-5]: Comparison of pain on cough during the postoperative period
*p-value significant

Parameters	Group R1	Group R2	p-value
Dose of Paracetamol	1560±993.03	1220±418.45	0.0280*
Dose of Tramadol	77±41.91	66±32.64	0.1463
Number of Paracetamol doses given	1.56±0.99	1.22±0.42	0.0280*
Number of Tramadol doses given	1.48±0.81	1.18±0.48	0.0272*
Total number of doses of rescue analgesia	3.04±0.53	2.4±0.49	<0.0001*

[Table/Fig-6]: Total number of doses of rescue analgesics.
*p-value significant

Heart rate	Group R1	Group R2	p-value
15 min	75.44 ± 8.62	73.66 ± 8.27	0.2946
30 min	76.64 ± 5.29	67.04 ± 5.02	<0.0001*
45 min	75.34 ± 6.23	69.08 ± 5.31	<0.0001*
1 hour	73.2 ± 8.69	69.8 ± 8.2	0.0469*
4 hours	76.3 ± 9.87	74.4 ± 9.3	0.3243
8 hours	76.76 ± 9.45	74.56 ± 7.76	0.2063
12 hours	74.52 ± 9.26	74.46 ± 9.06	0.9739
16 hours	76.66 ± 8.67	75.9 ± 9.12	0.6703
20 hours	73.92 ± 10.35	74.64 ± 10.12	0.7258
24 hours	74.94 ± 8.91	75.06 ± 9.2	0.9473
28 hours	77.24 ± 8.79	74.92 ± 8.06	0.1721
32 hours	74.8 ± 9.22	75.86 ± 9.15	0.5652
36 hours	76.58 ± 8.26	75.86 ± 5.72	0.6135
40 hours	75.7 ± 8.11	73.26 ± 8.25	0.1391
44 hours	74.04 ± 8.7	75.56 ± 9.23	0.3989
48 hours	73.42 ± 8.27	75.12 ± 8.97	0.3269

[Table/Fig-7]: Comparison of heart rate (beats per minute) during epidural infusion.
*p-value significant

Mean atrial pressure	Group R1	Group R2	p-value*
15 min	66.32 ± 8	60.04 ± 9.46	0.0005
30 min	82.08 ± 11.16	78.9 ± 9.06	0.1210
45 min	83.18 ± 9.7	80.88 ± 6.3	0.1629
1 hour	83.56 ± 10.62	80.28 ± 5.37	0.0542
4 hours	84.68 ± 4.96	82.8 ± 5.59	0.0784
8 hours	85.54 ± 4.96	83.52 ± 5.54	0.0577
12 hours	86.38 ± 6.07	83.22 ± 5.77	0.0089
16 hours	86.72 ± 5.37	85.58 ± 5.58	0.3005
20 hours	85.72 ± 5.77	84.2 ± 6.57	0.2219
24 hours	85.5 ± 5.47	83.48 ± 6.14	0.0855
28 hours	84.98 ± 5.47	84.62 ± 6.7	0.7691
32 hours	85.68 ± 5.71	85.46 ± 6.01	0.8515
36 hours	86.12 ± 5.73	85.36 ± 6.2	0.5259
40 hours	86.72 ± 5.89	86.44 ± 5.73	0.8101
44 hours	85.56 ± 5.72	83.54 ± 5.58	0.0770
48 hours	84.98 ± 5.42	84.72 ± 6.57	0.8295

[Table/Fig-8]: Table showing comparison of mean arterial pressure during epidural infusion.
*p-value significant

was higher in group R2, while group R1 also had motor blockade, but with less intensity. This pattern continued until 32 hours, after which there was a reduction in motor blockade and from 36 hours, motor blockade was comparable between groups.

DISCUSSION

In both groups, the demographic parameters were statistically comparable, with no significant differences in age, ASA grade, weight, height, BMI, blood pressure, pulse rate, and SpO_2 levels. This similarity between the groups ensured that the primary outcome measures were not influenced by baseline variability, thereby strengthening the reliability of our findings.

The current study revealed that the VAS score at rest was comparable between the two groups with a p-value of more than 0.05. According to the literature search, most of the studies compared VAS scores at rest, while the present study compared VAS scores on movement and coughing. In the current study, the VAS scores on movement and coughing were statistically significant (p-value <0.05). When compared with R2, R1 had higher VAS scores on movement until 32 hours and on cough until 40 hours. Bhasin S et al., analysed two separate concentrations of Ropivacaine 0.1% and

Motor blockade	Group R1	Group R2	p-value
15 min	1.59±0.4	2±0	<0.0001*
30 min	1.1±0.31	2± 0	<0.0001*
45 min	1±0	2± 0	<0.0001*
1 hour	1±0	2±0	<0.0001*
4 hours	1±0	1.66±0.48	<0.0001*
8 hours	1±0	1.64±0.48	<0.0001*
12 hours	1±0	1.6±0.49	<0.0001*
16 hours	1±0	1.4±0.49	<0.0001*
20 hours	1±0	1.14±0.35	0.0062*
24 hours	0.76±0.43	1.08±0.27	<0.0001*
28 hours	0. 43±0.5	1.04±0.2	<0.0001*
32 hours	0 .12±0.33	0 .8±0.4	<0.0001*
36 hours	0±0	0±0	-
40 hours	0±0	0±0	-
44 hours	0±0	0±0	-
48 hours	0±0	0±0	-

[Table/Fig-9]: Comparison of motor blockade during the postoperative period.
*p-value significant

0.2% with 0.125% Bupivacaine in total knee replacement surgeries as a postoperative epidural infusion for analgesia [8]. They found higher VAS scores in patients in the group with 0.1% Ropivacaine than in the group with 0.2% Ropivacaine. In a study conducted by Khandelwal H et al., the efficacy of three different concentrations of Ropivacaine, i.e 0.05% (group 1), 0.1% (group 2) and 0.2% (group 3) with 2 mcg Fentanyl in labour analgesia was compared [7]. They found that 90% of the patients in groups 2 and 3 received adequate analgesia and the VAS scores were comparable in both groups. A study by Wilson SH et al., evaluated the efficacy of 0.1% Ropivacaine (group 0.1%) versus 0.2% Ropivacaine (group 0.2%) for continuous lumbar plexus nerve block infusion as analgesia in total hip arthroplasty surgeries [13]. They found that 0.1% Ropivacaine provided analgesia as adequate as 0.2% Ropivacaine. Sawhney KY et al., compared different concentrations of Ropivacaine and Bupivacaine, such as 0.2% Ropivacaine (group 1), 0.1% Ropivacaine with 2 mcg/mL Fentanyl (group 2), 0.2% Bupivacaine (group 3), and 0.1% Bupivacaine with 2 mcg/mL Fentanyl (group 4) in lower limb surgeries as epidural infusion for pain relief [17]. The study results revealed that VAS scores were higher in group 4 and lower in group 1, showing that Ropivacaine yields better pain relief than Bupivacaine. The results of the study conducted by Fonseca R et al., correlate with the current study [18]. They compared 0.1% Ropivacaine with morphine (group RM1) and 0.2% Ropivacaine with morphine versus morphine as postoperative epidural infusion in C-section patients. They concluded that pain scores on movement and rest were comparable among the groups.

In the current study, 0.2% Ropivacaine had a longer duration of motor impairment for up to 32 hours, whereas 0.1% Ropivacaine had quicker recovery with less blockade after 24 hours. Fonseca R et al., compared 0.1% Ropivacaine with morphine (group RM1), 0.2% Ropivacaine with morphine versus morphine as postoperative epidural infusion in C-section patients [18]. Their results showed that motor block was a common side-effect in groups RM1 and RM2 and among them, group RM2 had a higher incidence of motor block than group RM1. This correlates with the current study. Bhasin S et al., evaluated the efficacy of 0.1% Ropivacaine (group R1), 0.2% Ropivacaine (group R2) with 0.125% Bupivacaine (group B) in total knee replacement surgeries for postoperative pain relief as epidural infusion [8]. Fentanyl 2 mcg/mL was added to all groups. They found that the group R1 had a lesser motor block when compared to group R2 and group B, with p-value=0.077, which supports the results of the current study. The study conducted by Pathak N et al., compared 0.1% Ropivacaine and 0.1% Ropivacaine with 2 mcg/

mL Fentanyl for postoperative analgesia through epidural infusion following major gynaecological surgeries [10]. They concluded that Bromage scores were comparable with p-value=0.0092. The results of the study conducted by Bawdane KD et al., concurred with the present study's results [14]. They evaluated the efficacy of 0.1% Ropivacaine with Fentanyl and 0.1% Bupivacaine with Fentanyl in labour epidural analgesia. They found that 0.1% Ropivacaine had lower Bromage scores and hence, provided lesser motor blockade.

Postoperative heart rate was significantly lower in group R2 at 30 minutes (p-value <0.0001), 45 minutes (p-value <0.0001), and 1 hour (p-value=0.0469), suggesting that 0.2% Ropivacaine had a greater impact on heart rate. However, beyond 4 hours, heart rate differences between the groups were no longer significant. Mean arterial pressure (MAP) was another critical haemodynamic parameter assessed in the current study. It was significantly lower in group R2 at 15 minutes (p-value=0.0005) and 12 hours (p-value=0.0089), highlighting a more pronounced vasodilatory effect with 0.2% Ropivacaine. The haemodynamic effects observed in the present study align with the findings of Hong JM et al., on the impact of Ropivacaine concentration [19]. The data showed 61.2% of hypotension incidence. Higher concentrations of Ropivacaine 0.75% have been associated with significant decreases in systemic vascular resistance (p-value=0.026) and MAP (p-value=0.039). Gupta A et al., analysed 0.125% Bupivacaine with Fentanyl and 0.125% Ropivacaine with Fentanyl for labour analgesia [4]. They observed that heart rate and MAP were comparable in both groups, with p-value>0.05, and concluded that Ropivacaine was an excellent alternative with fewer side effects.

In the present study, the requirement for postoperative rescue analgesia was higher in patients who received 0.1% Ropivacaine (group R1) compared to those who received 0.2% Ropivacaine (group R2), with a p-value <0.05. The results of Bhasin S et al., coincided with the results of this study [8]. They compared 0.1% Ropivacaine (group R1), 0.2% Ropivacaine (group R2), with 0.125% Bupivacaine (group B) in total knee replacement surgeries for postoperative pain relief and found that group R1 had a greater need for rescue analgesia with p-value <0.001and there was a significant difference between the three groups. Yang CW et al., evaluated the efficacy of 0.1% and 0.2% Ropivacaine and found that patients who received 0.1% Ropivacaine for pain relief needed more rescue analgesia in the first 24 hours, which correlates with the current study, and it implies that 0.1% Ropivacaine needed more rescue analgesia [12]. Bindra TK et al., compared 0.5% (group I) and 0.75% Ropivacaine (group II) and 0.5% Bupivacaine (group III) for postoperative analgesia in lower limb surgeries, in which group I that is the lesser concentration of Ropivacaine needed more Tramadol top ups (350±51.29 min) postoperatively, had more VAS scores and lesser motor blockade (2.35±0.49 min) which aligns with our study that 0.1% lesser concentration of Ropivacaine needed more rescue analgesia, had more VAS scores with lesser motor blockade [20].

Limitation(s)

The study had the following limitations. It was done only in patients who were admitted for abdominal hysterectomy. The adverse effects of the drug were not evaluated.

CONCLUSION(S)

From the current study it was concluded, that both 0.1% Ropivacaine with Fentanyl 2 mcg/mL and 0.2% Ropivacaine with Fentanyl 2 mcg/mL provided effective and equal postoperative analgesia only at rest in patients undergoing abdominal hysterectomy, whereas 0.2% Ropivacaine had lesser VAS scores that is adequate pain releif at movement and cough, while 0.1% had a lesser motor blockade and haemodynamic variability. Even though 0.2% Ropivacaine had a benefit of greater pain relief on movement and cough, it came with the side effect of greater motor blockade. Hence, the physician must make a concentration choice in accordance with the patient's needs.

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