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Original Article

Anaesthesia Section

Dexamethasone versus Dexmedetomidine as Adjuvants to Ropivacaine in Ultrasound-guided Rectus Sheath Block for Postoperative Analgesia in Patients Undergoing Exploratory Laparotomy: A Randomised Controlled Trial

AKSHI MANOHER[1], ABHIMANYU SINGH POKHRIYAL[2], ARTI RAJPUT[3]

ABSTRACT

Introduction: Midline laparotomies cause significant postoperative pain, which adds to high morbidity associated with them. Rectus Sheath Block (RSB), has emerged as a reliable technique for postoperative analgesia in abdominal surgeries and has been shown to significantly prolong postoperative analgesia and decrease pain scores in patients undergoing midline laparotomies.

Aim: To compare the duration and quality of postoperative analgesia with dexamethasone vs dexmedetomidine as adjuvants to 0.25% ropivacaine in Ultrasound (USG)-guided bilateral RSB for midline laparotomy patients.

Materials and Methods: This single centre double-blinded, randomised controlled trial was conducted over a period of 12 months at the Department of Anaesthesiology and Pain Medicine, Himalayan Institute of Medical Sciences, Swami Rama Himalayan University, Dehradun, Uttarakhand, India between year 2023 to 2024 and included 70 American Society of Anaesthesiologists (ASA) physical status I/II patients scheduled for midline laparotomy. They were randomly assigned to receive Ultrasound (USG)-guided, bilateral RSB with a total dose of 40 mL of 0.25% ropivacaine with 8 mg dexamethasone (Group-A), 40 mL of 0.25% ropivacaine with 1 µg/kg dexmedetomidine (Group-B) and 40 mL of 0.25% ropivacaine alone (Group-C). Postoperatively, tramadol was administered via Patient-Controlled Analgesia (PCA) by demand-only mode. The primary outcome was time to PCA activation, while secondary outcomes included 24-hour tramadol consumption, pain scores (at 30 minutes and at 1, 3, 6, 12, 18 and 24 hours), patient satisfaction and block-related complications. Unpaired t-tests were used for continuous variables, while the Chi-square test was applied to categorical data. Analysis of Variance (ANOVA) was performed to assess vital parameters and to compare differences across the three groups.

Results: All three groups were comparable in terms of demographic variables like age, weight and gender distribution. PCA activation time was longest in Group-A (102.27±32.79 min) vs. Group-B (73.18±24.08 min) and Group-C (39.77±21.84 min) ($p<0.001$). Tramadol consumption was lowest in Group-A (279.54±100.31 mg) ($p=0.002$). Pain scores and patient satisfaction favoured Group-A ($p=0.001$, $p=0.031$, respectively).

Conclusion: Dexamethasone with ropivacaine in RSB demonstrated superior analgesic efficacy in terms of better pain scores, longer time to activate PCA pump and overall lowest 24-hour tramadol consumption than ropivacaine alone. The overall patient satisfaction in terms of pain management was better in dexamethasone group as compared to dexmedetomidine with ropivacaine and ropivacaine alone.

Keywords: Local anaesthetic, Nerve block, Opioid dependence, Patient-controlled analgesia, Postoperative pain

INTRODUCTION

Over the past years, the concept of pain management has extended from simply decreasing pain intensity to optimising patient's condition. The goal is to decrease pain scores, stress response that should be avoided in patients, particularly cardiac patients, together with a decrease in analgesics-related side-effects like nausea, vomiting, retention of urine and excessive sedation [1]. Midline laparotomies are associated with severe postoperative pain, which can delay recovery, impair immune function and increase opioid consumption and opioid related complications [2]. Inadequately managed post-surgical pain not only hampers patient recovery but can also lead to increased use of opioids and the risk of their potential misuse [3]. Contraindications, complications and the cost of neuraxial analgesia, which is widely used for abdominal surgery, require the exploration of alternative analgesia modalities [4].

The RSB has emerged as a reliable technique for postoperative analgesia in abdominal surgeries [5]. RSB was first introduced by Schleich in 1899 and involves injecting Local Anaesthetic (LA) into the space between Rectus abdominis muscle and posterior rectus sheath, blocking the ventral branches of the T6-T12 thoracic nerves [6]. Dense and consistent analgesia is produced along the anterior wall from the xiphoid process to the symphysis pubis. As a result, it is helpful in procedures involving midline abdominal incisions. Initially performed via landmark techniques, its efficacy has improved with use of ultrasound, leading to denser and more consistent analgesia [7]. Ultrasound shortens onset period, lowers total anaesthetic dosage requirement, increase block success rates and reduces complications linked to regional anaesthesia [8]. There are also the benefits of direct observation of patterns of anaesthetic spread. RSB offers several

advantages, including early ambulation, reduced opioid use, minimal motor blockade and lower risk of deep vein thrombosis, pulmonary embolism and respiratory infections [9]. However, conventional LA like ropivacaine has a limited duration of action, necessitating the use of adjuvants with them to prolong the duration of analgesia [10].

Dexamethasone and dexmedetomidine are commonly used nonopioid adjuncts, shown to enhance the duration and quality of regional nerve blocks. Dexamethasone is a corticosteroid, which reduces inflammation and prolongs analgesia by modulating inflammatory mediators [7]. Dexmedetomidine is a α-2 adrenergic receptor agonist, it enhances analgesia by inhibiting pain signal transmission hence, prolonging the effect of LAs and reducing opioid consumption [11]. With the growing focus on opioid-free anaesthesia, these adjuvants present a promising role in postoperative pain control [12].

A study by Salem WT et al., demonstrated that using dexmedetomidine as an adjuvant to bupivacaine in US-guided bilateral RSB during abdominal surgery with midline incisions in cancer patients was associated with a significant decrease in postoperative pain and total morphine consumption, as well as a decrease in postoperative cortisol levels [1]. Upasana et al., demonstrated that, General Anaesthesia (GA) when combined with USG-guided RSB yields superior analgesia in umbilical hernia surgery patients. They found that amongst bupivacaine, ropivacaine and levobupivacaine, ropivacaine provided excellent analgesia for 10 hours postoperatively. Their patients were also able to mobilise earlier since there was no motor block of the limbs [9]. An observational study by Teshome D et al., in patients undergoing midline laparotomy showed that adding a bilateral RSB at the end of the surgery was an effective postoperative analgesic option [13]. A study was conducted by Singla N et al., (2021) on analgesic efficacy of Dexamethasone versus Dexmedetomidine as an adjuvant to Ropivacaine in ultrasound-guided Transversus Abdominis Plane (TAP) block in patients undergoing elective caesarean section. They observed that patients who were given an adjuvant, as compared to those with placebo, has prolonged time to initial postoperative pain and time to first rescue analgesia [14]. Keeping these experiments in mind, the authors hypothesised that use of dexamethasone and dexmedetomidine as an adjuvant to RSB will prolong postoperative analgesia and decrease pain scores in patients undergoing midline laparotomies. The present study aimed to evaluate and compare the efficacy and safety of dexmedetomidine and dexamethasone in RSB when used with ropivacaine and measure the duration and quality of analgesia. The primary objective was to compare the duration of postoperative analgesia provided by dexamethasone versus dexmedetomidine as adjuvants to 0.25% ropivacaine in bilateral RSB. Secondary objective was to assess quality of pain control using Visual Analogue Scoring (VAS) scale and patient satisfaction in overall pain management using 6-point Likert scale at 24 hours after surgery. In addition, adverse effect or complications, if any were recorded in each group.

MATERIALS AND METHODS

The present single centre, double-blinded randomised controlled study was conducted over a period of 12 months at the Department of Anaesthesiology and Pain Medicine, Himalayan Institute of Medical Sciences, Swami Rama Himalayan University, Dehradun, Uttarakhand, India, between year 2023 to 2024. Ethical approval was obtained from the Institutional Ethical Committee (vide approval number SRHU/HIMS/RC/2024/328) and this trial is registered with Clinical Trials Registry-India (vide registration number CTRI/2024/01/062115). Informed written consent was taken from all participants for their involvement in the study.

Sample size calculation: The sample size by using the widely used software. Since the comparisons of the VAS score was performed using the Chi-square statistics, the authors, therefore, selected the effect size of 0.6, with an alpha (α) error of 0.05 (widely used) and power (1-β err prob) of 0.80. The computed sample size was 22 patients. For a Chi-square test, the sample size is based on the relationship between effect size and the non-centrality parameter:

$\lambda=N.w^2$

Given:

So:

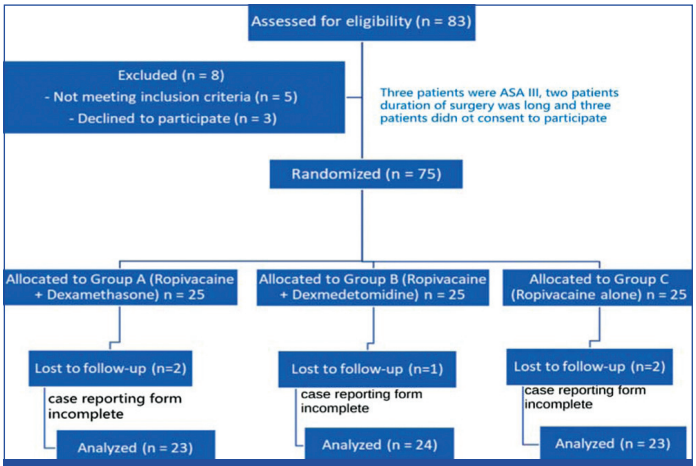
$N=\lambda/ w^2=\{7.92/(0.6)^2=7.92/(0.36)$

$=22$

To compensate for the possible drop outs sample size of 25 was kept in each group.

A recent study by Oriba AAA et al., (2021) has demonstrated that both dexamethasone and dexmedetomidine were efficient adjuvants to local anaesthetics as they were associated with a significant prolongation of duration of analgesia, decrease in postoperative analgesic consumption, and has led to better patient satisfaction compared to bupivacaine alone [15].

Manuscript preparation adhered to Consolidated Standards of Reporting Trials (CONSORT) guidelines [Table/Fig-1]. Block randomisation was performed using online website (https://www.randomizer.org). This random allocation sequence was concealed in sequentially numbered opaque, sealed envelopes which were opened on the day of surgery. The co-investigator who performed the block was blinded to the groups allocated. Investigator and nurses who collected postoperative data were also blinded for the group allocations. A total of 83 patients were assessed for eligibility out of which 75 were recruited and randomised. Finally, study was completed in 70 patients as five patients were lost to follow-up.



[Table/Fig-1]: CONSORT flow diagram.

Inclusion and Exclusion criteria: Patients who were scheduled for exploratory laparotomy with midline incision under GA were assessed for eligibility. Patients aged between 18-60 years of either sex with American Society of Anaesthesiologists (ASA) physical status I and II and who understood the study's rationale were included in study. Patients with history of allergy to study drugs, bleeding diathesis, active skin infection at the injection site, pregnancy and morbid obesity were excluded from study. Those included in study were explained about the procedure, pain scores and use of the PCA pump preoperatively.

Study Procedure

On the day of surgery, after securing an intravenous (i.v.) access, standard ASA monitors were attached and baseline Heart Rate (HR), Non Invasive Blood Pressure (NIBP), Electrocardiogram (ECG) and oxygen saturation (SpO_2) was recorded. GA was induced using fentanyl 2 μg/kg, propofol 2 mg/kg and atracurium 0.5 mg/kg, i.v.. This was followed by tracheal intubation with an appropriately sized cuffed endotracheal tube. Anaesthesia was maintained with oxygen

in air and sevoflurane to maintain a minimum alveolar concentration of 1-1.2. All patients received i.v. paracetamol 15 mg/kg after induction of anaesthesia.

At the end of the surgical procedure before extubation, bilateral RSB was performed under strict aseptic conditions with Ultrasound (USG) using high frequency (6-13 MHz) linear probe (Ultrasound machine M-Turbo, Fujifilm Sonosite, Inc.21919, Bothell, WA 98021, United States) and spinal needle (BD Quincke's Spinal Needle 23 G x 3 1/2 inches). An experienced anaesthesiologist who had performed at least 25 such blocks gave these blocks. He was not involved in perioperative management or data collection. Group-A, 20 mL of 0.25% ropivacaine with 4 mg dexamethasone was given each side, [16] whereas, Group-B received 20 mL of 0.25% ropivacaine with dexmedetomidine (1 µg/kg) each side and Group-C patients were given 20 mL of plain 0.25% ropivacaine each side [17]. At the end, all patients received injection ondansetron 0.1 mg/kg and were reversed with neostigmine 50 µg /kg and glycopyrrolate 10 µg/kg i.v.. After extubation, patients were shifted to the Post Anaesthesia Care Unit (PACU). In PACU, each patient was connected to a PCA pump (CADD Legacy™ PCA, Smiths Medical International Ltd., USA) programmed for demand-only mode with bolus of tramadol 20 mg, with 10-minute lockout interval and 4-hour dose limit of 100 mg.

Outcomes: The primary outcome was the time to activate the PCA pump postoperatively which indirectly was taken as time duration of analgesia provided by block. The secondary outcomes were 24-hour tramadol consumption, VAS scoring at 30 minutes, 1, 3, 6, 12, 18 and 24 hours and patient satisfaction score about overall pain management using 6-point Likert scale at 24 hours after surgery. Adverse effects such as nausea, vomiting and any other complication were also recorded.

STATISTICAL ANALYSIS

Data analysis was conducted using Statistical Package for Social Sciences (SPSS) version 16.0 (Chicago, Inc., USA) and Microsoft Excel. Qualitative variables (e.g., gender, ASA physical status and side-effects) were summarised as frequencies and percentages, while quantitative variables (e.g., time to PCA activation, total tramadol consumption and VAS scores) were expressed as mean±Standard Deviation (SD). Statistical significance was set at $p<0.05$. Unpaired t-tests were used for continuous variables, while the Chi-square test was applied to categorical data. ANOVA was performed to assess vital parameters and to compare differences across the three groups.

RESULTS

Demographic data: Demographic characteristics like age and sex were comparable between three groups ($P>0.05$). Mean age in all three groups was statistically non significant. Groups were also comparable in terms of gender distribution, ASA classification and Body mass index. Average duration of surgery was also statistically non significant [Table/Fig-2].

Parameters	Group-A (n=23)	Group-B (n=24)	Group-C (n=23)	p-value
Age (years)	38.54±12.58	34.77±12.21	33.59±14.31	0.39
Gender (male/female)	10/13	14/10	15/8	0.28
Body mass index (kg/m^2)	23.52±2.49	23.70±2.54	23.56±3.36	0.96
ASA physical status (I/II)	13/10	17/7	16/7	0.62
Duration of surgery (minutes)	157.72±47.20	161.81±52.3	164.81±49.05	0.87

[Table/Fig-2]: Demographic variables and duration of surgery.
Data expressed as mean±SD or frequency; n: number of patients; ASA: American society of anaesthesiologists

VAS Scores

Intergroup comparison using One-way ANOVA revealed a statistically highly significant difference in VAS scores among the three groups at all-time intervals ($p<0.001$) [Table/Fig-3]. Post-hoc analysis using Tukey HSD demonstrated that Group-A had significantly lower VAS scores compared to Group-B and C at all time intervals ($p<0.05$). No significant difference was observed between Group-B and C in the early postoperative period (30 minutes to 3 hours) [Table/Fig-4].

Time	Group-A	Group-B	Group-C	p-value
30 min	2.81±0.58	3.36±0.58	3.45±0.50	<0.01*
1 h	2.18±0.50	2.77±0.52	2.90±0.42	<0.01*
3 h	1.77±0.52	2.31±0.64	2.63±0.58	<0.01*
6 h	1.22±0.52	1.86±0.63	2.09±0.42	<0.01*
12 h	0.68±0.56	1.36±0.49	1.63±0.49	<0.01*
18 h	0.18±0.39	1.04±0.57	1.22±0.42	<0.01*
24 h	0.13±0.35	0.50±0.59	0.90±0.42	<0.01*

[Table/Fig-3]: VAS scoring in all three groups.
p-value <0.001 is considered highly significant

Time/Group	AxB (p-value)	AxC (p-value)	BxC (p-value)
30 min	0.002*	<0.001*	0.78
1 h	<0.001*	<0.001*	0.62
3 h	0.004*	<0.001*	0.18
6 h	<0.001*	<0.001*	0.29
12 h	<0.001*	<0.001*	0.21
18 h	<0.001*	<0.001*	0.39
24 h	0.11	<0.001*	0.06

[Table/Fig-4]: Post-hoc analysis of VAS scoring in all three groups.
p-value <0.05 is considered significant, * statistically significant

Time to Activation of PCA and 24-h Tramadol Consumption among Groups

There was a statistically significant difference among the three groups with respect to time to activation of PCA. The mean time to activation was highest in Group-A followed by Group-B and lowest in Group-C. Post-hoc analysis demonstrated significant differences between Group-A and B, Group-B and C and Group-A and C. Similarly, 24-hour tramadol consumption differed significantly among the groups. Mean tramadol consumption was highest in Group-C, followed by Group-B and lowest in Group-A. Post-hoc comparison revealed a statistically significant difference between Group-A and C, while differences between Group-A and B and between Group-B and C were not statistically significant [Table/Fig-5].

Mean Arterial Blood Pressure

The mean blood pressure differed significantly among three group at time points of 30 minutes and 12 hours, however, in all three groups, the mean blood pressure remained within normal limits from 30 minutes to 24 hours [Table/Fig-6]. On post-hoc analysis, significant intergroup differences were observed at 30 minutes, one hour and 12 hours. Group-C had significantly higher mean blood pressure at intervals 30 minutes and one hour, compared to Groups-A and B. At 12 hours, Group-B showed significantly lower values compared to Groups-A and C. No statistically significant differences were observed at 3, 6 and 24 hours [Table/Fig-7].

Heart Rate (HR)

On using One-way ANOVA, calculated p-values for mean HR among three groups showed significant difference at most of time points from 30 minutes to the 24 hours. Patients in Group-B consistently demonstrated lower HR value compared to Group-A and Group-C

Variables	Group-A (n=23)	Group-B (n=24)	Group-C (n=23)	Post-hoc analysis Mean Difference (95% CI) between Groups: A and B	B and C	A and C	p-value
Time to activation of PCA (minutes)	102.27±32.79	73.18±24.08	39.77±21.84	29.09 (11.05, 47.13)	33.41 (18.99, 47.82)	62.50 (45.03, 79.97)	<0.01*
24-h tramadol consumption (mg)	279.54±100.31	332.72±103.93	383.63±65.79	-53.18 (-117.22, 10.86)	-50.91 (-105.45, 3.63)	-104.09 (-157.28, -50.90)	<0.01*

[Table/Fig-5]: Time to activation of PCA and 24-hour tramadol consumption among groups with post-hoc analysis.
Data expressed as mean±SD; CI: Confidence interval; PCA: Patient-controlled analgesia; n: number of patients; p-value <0.05 was considered significant; *highly significant

Time	Group-A	Group-B	Group-C	p-value
30 min	94.18 (11.92)	93.09 (14.37)	104.54 (11.90)	<0.01*
1 h	91.04 (8.76)	90.68 (11.36)	98.36 (10.28)	0.042
3 h	92.13 (8.11)	92.13 (8.11)	91.68 (9.98)	0.66
6 h	90.59 (6.39)	91.45 (8.24)	90.68 (11.08)	0.73
12 h	92.90 (7.53)	89.09 (8.36)	92.18 (8.42)	<0.01*
18 h	90.63 (6.93)	87.09 (10.11)	91.50 (10.46)	0.67
24 h	89.36 (7.11)	89.95 (8.98)	91.09 (10.66)	0.80

[Table/Fig-6]: Comparison of mean blood pressure at different time intervals.
Data expressed as mean±SD; p-value <0.05 was considered significant; *Highly significant

Time/Group	AxB (p-value)	AxC(p-value)	BxC (p-value)
30 min	0.91	<0.01*	<0.01*
1 h	0.98	0.04*	0.03*
3 h	1.00	0.97	0.97
6 h	0.95	0.99	0.96
12 h	0.03*	0.88	0.04*
18 h	0.28	0.94	0.25
24 h	0.96	0.78	0.85

[Table/Fig-7]: Post-hoc analysis of mean blood pressure at different time intervals.
p-value <0.05 was considered significant; *statistically significant

[Table/Fig-8]. Post-hoc analysis showed statistically significant difference between Group-A and B and between Group-B and C at most of the time intervals [Table/Fig-9].

Time	Group-A	Group-B	Group-C	p-value
30 min	85.09 (12.13)	80.77 (8.94)	90.9 (12.87)	<0.001*
1 h	82.95 (12.98)	79.9 (7.31)	88.04 (12.97)	<0.001*
3 h	82.95 (13.11)	75.04 (6.67)	85.45 (14.17)	<0.001*
6 h	81.9 (11.3)	75.72 (5.71)	83.81 (15.36)	<0.001*
12 h	81.63 (11.97)	74.81 (6.89)	83.45 (14.33)	<0.001*
18 h	80.31 (10.76)	73.0 (5.68)	81.95 (14.27)	<0.001*
24 h	80.81 (10.87)	73.45 (7.25)	80.81 (13.97)	<0.001*

[Table/Fig-8]: Comparison of Heart Rate (HR) at different time intervals.
Data expressed as mean±SD; p-value <0.05 was considered significant; *Highly significant

Time/Group	AxB (p-value)	AxC (p-value)	BxC (p-value)
30 min	0.34	0.28	0.01*
1 h	0.56	0.36	0.07
3 h	0.015*	0.81	<0.01*
6 h	0.041*	0.89	0.04*
12 h	0.025*	0.91	0.02*
18 h	0.013*	0.93	0.01*
24 h	0.034*	1.00	0.03*

[Table/Fig-9]: Post-hoc analysis of mean Heart Rate (HR) at different time intervals.
p-value <0.05 was considered significant; *statistically significant

SPO_2

The SPO_2 remains elevated in Group-A as compared to Group-B and Group-C. Post-hoc analysis revealed that statistically significant difference observed across groups A and C and B and C, at all the time intervals due to significantly lower levels of SPO_2 in Group-C than Group-A and B [Table/Fig-10,11].

Time/Group	Group-A	Group-B	Group-C	p-value
30 min	99.63±0.72	99.95±0.21	95.04±1.33	<0.01*
1 h	99.31±0.83	99.95±0.21	98.81±1.36	<0.01*
3 h	99.18±0.95	99.54±0.67	98.36±1.17	<0.01*
6 h	99.36±0.72	99.31±0.71	98.18±1.33	<0.01*
12 h	99.59±0.59	99.40±0.79	98.36±1.36	<0.01*
16 h	99.59±0.79	99.59±0.79	98.50±1.05	<0.01*
24 h	99.59±0.59	99.68±0.71	98.86±1.08	<0.01*

[Table/Fig-10]: Comparison of SPO_2 at different time intervals.
p-value <0.05 was considered significant; *Highly significant Data expressed as mean±SD

Time/Group	AxB (p-value)	AxC (p-value)	BxC (p-value)
30 min	0.08	<0.001*	<0.001*
1 h	0.06	<0.001*	<0.001*
3 h	0.12	<0.001*	<0.001*
6 h	0.85	<0.001*	<0.001*
12 h	0.40	<0.001*	<0.001*
18 h	1.00	<0.001*	<0.001*
24 h	0.60	<0.001*	<0.001*

[Table/Fig-11]: Post-hoc analysis of SPO_2 at different time intervals.
p-value <0.05 was considered significant; *Highly significant

Overall Patient Satisfaction in Terms of Pain Management

A statistically significant difference was observed in overall pain management scores using Chi-square test, among the three groups (χ^2=13.84, df=6, p=0.031). Group-A demonstrated a higher proportion of participants reporting agreement and strong agreement compared to Groups-B and C. The effect size was moderate (Cramer's V=0.31), indicating a meaningful difference in perceived pain management across groups [Table/Fig-12].

Response	Group-A	Group-B	Group-C	p-value
Strongly disagree	0	0	0	<0.031*
Disagree	0	0	0	
Slightly disagree	0	4 (16.66%)	6 (26.08%)	
Slightly agree	10 (43.47%)	14 (58.33%)	12 (52.17%)	
Agree	11 (47.82%)	5 (20.83%)	5 (21.73%)	
Strongly agree	2 (8.69%)	1 (4.17%)	0	
Total	23 (100%)	24 (100%)	23 (100%)	

[Table/Fig-12]: Overall pain management using Likert Scale.
Data expressed as n (%) p-value <0.05 was considered significant; *statistically significant

Complications

No complications were recorded in Group-A. However, in Group-B vomiting was reported in three patients, nausea occurred in one patient and fever was seen in one patient. In Group-C, vomiting was reported in one patient while two patients complained of nausea postoperatively.

DISCUSSION

The present randomised controlled trial evaluated the efficacy of dexamethasone and dexmedetomidine as adjuvants to 0.25% ropivacaine in USG-guided RSB for postoperative analgesia in patients undergoing exploratory laparotomy with midline incision. The present study demonstrates that dexamethasone significantly

enhanced analgesic efficacy, as evidenced by prolonged duration to PCA activation, lower VAS scores and reduced tramadol consumption over 24-hours.

The mean time to PCA activation in Group-A was substantially longer compared to Group-B and Group-C, suggesting more sustained analgesic effect. Furthermore, pain scores exhibited a declining linear trend in all groups; however, Group-A consistently maintained lower VAS scores across all time points. This improvement translated into better subjective pain control, including higher patient satisfaction and improved sleep quality, without any associated complications. Maurya RG et al., reported that dexamethasone significantly prolonged duration of analgesia with ropivacaine in brachial plexus block [18]. Wu KW et al., demonstrated similar efficacy in thoracic paravertebral block, where dexamethasone improved postoperative analgesia and reduced need for opioids [19]. According to study done by Sridhar RB et al., dexamethasone group had mean analgesic duration of 450 minutes, while dexmedetomidine had analgesic duration of 406.25 minutes [20]. In paediatric population, Janusz P et al., found that dexamethasone as a perineural adjuvant to ropivacaine enhanced pain relief following sciatic nerve block [21]. Dexamethasone was shown to be better than dexmedetomidine in an indirect adjusted meta-analysis of 49 trials as its analgesic effect lasted for 148 minutes longer than dexmedetomidine while posing no hazards of sedation or hypotension [22].

In the present study, the mean consumption of tramadol was significantly lower in Group-A as compared to the Group-B and C. Oriba AAA et al., also reported a decrease in analgesic consumption in the dexamethasone group [15]. In the study by Singh N et al., it was found that adding 1 µg/kg dexmedetomidine or 8 mg dexamethasone as an adjuvant to 30 mL ropivacaine (0.5%), in ultrasound-guided SCBP block results in significantly decreases in total 24 hours analgesic consumption [23]. Similar results were seen when dexamethasone was added to bupivacaine in TAP block, where in dexamethasone group, total postoperative 24-hour morphine consumption was much lower [14]. The exact method by which dexamethasone extends the duration of nerve blocks is unknown, it is believed to do so by altering the function of the potassium channels, which in turn amplifies the effects of LAs. While dexmedetomidine works by preventing nerve signals from travelling through the C and A delta fibres. It may also cause the release of chemicals like encephalin at peripheral locations, which would increase the potency of LA effects and lengthen their analgesic duration [24].

Haemodynamic parameters like mean arterial pressure were significantly different amongst three groups. Group-C had significantly higher mean blood pressure at intervals 30 minutes and one hour, compared to Groups-A and B. At 12 hours, Group-B showed significantly lower values compared to Groups-A and C. Similarly, patients in Group-B consistently demonstrated lower HR value compared to Group-A and Group-C. Group-B showed lower mean BP and mean HR which can be attributed to use of dexmedetomidine as adjuvant. In an experiment by Singh TS et al., patients receiving dexmedetomidine had lower blood pressures and perioperative HRs [25]. The lower levels of SpO_2 observed in Group-C may be because of higher pain scores in Group-C affecting respiratory movements in them.

Group-A has higher proportion of participant reporting agreement and strong agreement towards overall pain management compared to Groups-B and C. This translates into better patient satisfaction in terms of quality of pain control in group receiving combination of ropivacaine with dexamethasone in RSB.

In the present study, no complications were seen in Group-A whereas vomiting, nausea and fever was reported in few cases in Group-B and C reinforcing antiemetic properties of dexamethasone. Gupta G et al., also compared dexmedetomidine and dexamethasone as adjuvants reported that while both were effective, dexmedetomidine was associated with more adverse events such as sedation and nausea [26]. From clinical standpoint, the combination of ropivacaine and dexamethasone provided effective analgesia with superior tolerability. These outcomes renounce dexamethasone as a safe and effective adjuvant, potentially enhancing postoperative recovery, minimising opioid consumption and improving overall patient comfort.

Limitation(s)

The follow-up period was limited to 24 hours postoperatively and longer-term data may further elucidate the comparative effectiveness of these agents. The use of a common dose of dexamethasone 8mg in all patients with diverse body weight may be the reason for better outcomes in dexamethasone. In addition, sleep quality and satisfaction were assessed via patient-reported outcomes, which may have led to reporting bias.

CONCLUSION(S)

To conclude, combination of dexamethasone with ropivacaine and dexmedetomidine used in RSB demonstrated superior analgesic efficacy in terms of better pain scores, longer time to activate PCA pump and overall lowest 24-hour tramadol consumption than ropivacaine alone, thus accepting the study hypothesis. The overall patient satisfaction was better in dexamethasone group as compared to dexmedetomidine with ropivacaine and ropivacaine alone. Dexmedetomidine group showed better haemodynamic stability. Therefore, inclusion of dexamethasone and dexmedetomidine as an adjuvant to LA in RSB can be included in enhanced recovery after surgery protocols to facilitate recovery and escalate discharge.

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PARTICULARS OF CONTRIBUTORS:
1. Senior Resident, Department of Anaesthesiology and Pain Medicine, Himalayan Institute of Medical Sciences, Swami Rama Himalayan University, Dehradun, Uttarakhand, India.
2. Associate Professor, Department of Anaesthesiology and Pain Medicine, Government Doon Medical College, Dehradun, Uttarakhand, India.
3. Assistant Professor, Department of Anaesthesiology and Pain Medicine, Himalayan Institute of Medical Sciences, Swami Rama Himalayan University, Dehradun, Uttarakhand, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Arti Rajput,
B18/2, HIHT Campus, Swami Rama Himalayan University, Swami Ram Nagar, Doiwala, Dehradun-248140, Uttrakhand, India.
E-mail: drartirajput4@gmail.com

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