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Evaluation of the analgesic efficacy of dexmedetomidine as an adjuvant to local anesthesia in quadratus lumborum block after cesarean section: A randomized controlled trial

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ABSTRACT

Background: Effective analgesia following surgery promotes the delivery mother's rapid recovery, improves early ambulation, promotes nursing, and lowers the risk of postoperative thromboembolism. The purpose of this work was to assess the postoperative analgesic efficiency of mixing local anesthetic with dexmedetomidine (DEX) in quadratus lumborum block (QLB) after a cesarean section (CS).

Methods: 50 patients who underwent a cesarean delivery under spinal anesthesia with an average body mass index (BMI) ranging from 18.5 to 34.9 Kg/m^2 participated in this double-blinded randomized-controlled study. Two equally sized groups of patients were formed: Group B got QLB with 20 ml of 0. 25% bupivacaine on both sides in addition to DEX 0.5 µg/kg, while group A received QLB with 20 ml of 0.25% bupivacaine in each side alone.

Results: The total amount of morphine used in the initial 24 hours after surgery and the number of patients who require morphine at 8, twelve, and 24 hours later were substantially decreased in group B than in group A. There was a significant decrease in time to first ambulation and in the Numerical Rating Scale (NRS) after four hours postoperatively in group B than in group A. In group B, three individuals experienced bradycardia, and two patients experienced hypotension as DEX-related side effects.

Conclusions: The period of postoperative analgesia is prolonged, and the administration of opiates after surgery is decreased when DEX is added to local anesthetics in QLB.

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1. Introduction

Since postoperative pain is among the primary difficulties following abdominal surgeries, effective pain management is one of the key concerns in medical practice. One of the most frequent abdominal procedures is a cesarean section (CS), and its utilization has reached record levels globally [1,2]

Effective analgesia following surgery promotes the postpartum mother's rapid recovery, promotes early ambulation, encourages nursing, and lowers the postoperative thromboembolism risk [3,4]. Opioids are frequently recommended for postoperative pain relief, but they have a variety of negative adverse impacts, including addiction, excessive sedation, vomiting, nausea, constipation, and dizziness [5]. It consequently becomes essential to use alternative opioid-sparing analgesic approaches.

The quadratus lumborum block (QLB) was initially stated in 2007; in QLB I, the transversalis fascia was injected at the quadratus lumborum muscle's anterolateral borders. The injection location for the QL block method was changed in 2015 to the posterior border rather than the anterolateral border (QL block II) [6]. QL block is now regarded as a postoperative pain control method utilized in patients with different pelvic and abdominal processes. Because of the dispersion of local anesthetic into the paravertebral region, the quadratus lumborum block reduces both somatic and visceral pain components [6,7].

According to studies contrasting the analgesic effectiveness of QLB and TAP block following cesarean delivery, QLB II is superior to TAP Block concerning pain reduction and impact duration [8]. Additionally, several studies have shown that adding adjuvants, such as fentanyl, clonidine, and MgSO4, to local anesthetics extends their analgesic effects and reduces 24-hour opiate use [9,10]. Dexmedetomidine (DEX) is a selective alpha-2 adrenergic agonist and one of many adjuvants frequently used in local procedures [10,11].

Although the ideal amount of DEX to add to local anesthetics is still unknown, several studies have

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shown that 0.5 µg/kg is a commonly used dose with no postoperative problems [12].

To the best of our knowledge, no trials were reported assessing the analgesic effectiveness of combining DEX with local anesthetic in block of quadratus lumborum after cesarean deliveries. This study aimed to evaluate the effectiveness of adding DEX to local anesthetic for postoperative pain relief in quadratus lumborum blocks after cesarean delivery.

2. Materials and methods

This randomized-controlled work was performed on 50 individuals with ASA II and a body mass index (BMI) of 18.5–34.9 kg/m^2 after cesarean sections under spinal anesthesia. The study was conducted after receiving approval from Cairo University's Ethical Committee (MD-75-2020 code) and being registered with ClinicalTrials.gov (ID: NCT04748224). Patients provided signed permission after being fully briefed.

The criteria for exclusion included a history of blood coagulation disorders, having lesions or infection at the suggested needle area, having a history of opioid addiction, having an allergy to or contraindication to the study's drugs, or having difficulty being recognized by ultrasonography.

Patients were randomly assigned to one of two groups utilizing a computer-generated table; the randomization order was then hidden in sealed envelopes, the anesthesiologist was unaware of the patient's group allocation, and a blinded observer collected the research data. Participants were divided into two equally matched groups. Participants received QLB with 20 ml of 0.25% bupivacaine on both sides for group A (bupivacaine alone), and 20 ml of 0.25% bupivacaine on both sides received plus dexmedetomidine 0.5 µg/kg for group B (bupivacaine plus DEX).

All patients had a pre-anesthesia checkup that included standard and subjective tests. The Numerical Rating Scale (NRS), which ranges from 0 to 10, was also discussed.

The night before the operation and in the morning, the patients received oral pantoprazole 40 mg as premedication.

A 25-gauge Quincke Bevel type needle (Spinocan®, Braun Melsungen AG, Germany) was used to administer spinal anesthesia. At the same time, the patient was seated using 10 mg of hyperbaric bupivacaine (AstraZeneca Pharmaceuticals, UK) and 25 µg of fentanyl. Participants were positioned supine with left uterine displacement, an ephedrine infusion was administered at a rate of 4 µg/min to minimize postspinal hypotension, and a face mask was used to provide 6 L/min of oxygen.

All patients got 1 gm of paracetamol intravenously after the procedure. An expert anesthetist conducted the QLB on the patient after washing the abdomen with surgical solution, covering the incision, and putting them in the lateral decubitus posture.

3. Quadratus lumborum block

After adjusting imaging depth and gain, a convex (5–8 MHz) ultrasonic probe (Shenzhen Mindray BIO-Medical Electronics, Model: DP-20, China) with a protective sheath was utilized.

Three anterior muscles of the abdominal (transversus abdominis, IO, and EO) were identified by placing a probe above the iliac crest midaxillary. Then, scanning dorsally while maintaining the transverse position until aponeurosis of the transversus abdominus was visualized, Observe QL muscle, psoas major in front of QL, and erector spinae muscle behind QL, to recognize the Shamrock pattern, a Spinocan® A 21 G 100-mm needle (B. Braun, Melsungen AG, Germany) was placed in plane under real-time US-guidance through the abdomen wall. To locate the most suitable injection detected over the lumbar interfacial triangle, 2 milliliters of 0.9% saline were administrated to examine the solution distribution (hydro-dissection). Each side of Group A given a twenty ml injection of 0. 25% bupivacaine. Group B received an administration of 20 ml of 0.25% bupivacaine on every side, along with DEX 0.5 µg/kg and half the dosage of Precedex (Hospira, Inc., Lake Forest, USA) for each side. Figure 1

When patients were completely aware, hemodynamically stable, and pain-free, they were released from the post-anesthesia care unit (PACU).

Every eight hours, 1 gm of paracetamol IV was given to each patient. When the Numerical Rating Scale (NRS) was over 3, IV morphine (0.05 mg/kg) was administered as an emergency analgesic; the daily maximum dosage of morphine was 30 mg.

Our primary outcome was to measure the total amount of morphine consumption in the first 24 hours postoperative at predetermined time intervals (4, 8, 12, and 24) hrs.

Secondary outcomes included; the number of patients who needed morphine postoperative, NRS at four, eight, twelve, and twenty-four hours after surgery, time to first ambulation postoperatively, QLB adverse effects, e.g., intestinal perforation, collection of blood and precedex side effects, e.g., hypotension (defined as MAP <65 mmHg or decrease than basal MAP by 20% and was treated with IV fluid), bradycardia (defined as HR < 50 beats/min and was treated by IV atropine 0.02 mg/kg).

4. Sample size calculation

The University of Kiel in Germany used G*Power 3.1.9.2 to measure the sample size. From earlier studies, it was estimated that following quadratus block, people consumed 10.22 ± 2.79 mg of morphine in 24 hours [13]. With a study's statistical power of 80% and assuming

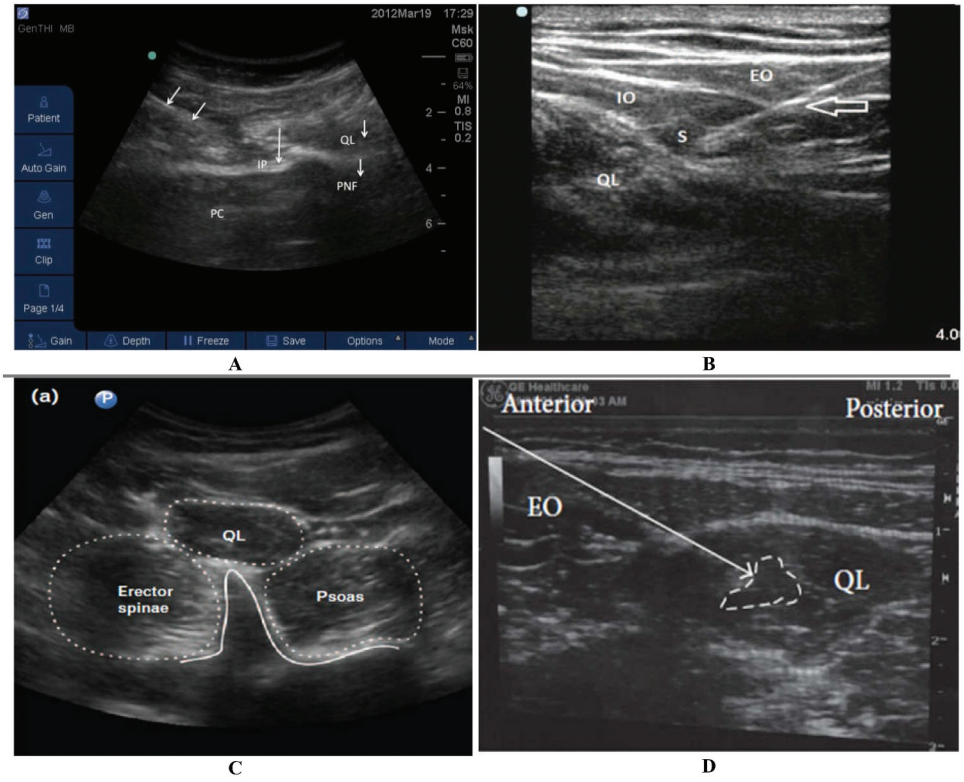

Figure 1. Ultrasound images of A) lateral QLB, arrows in upper left corner indicating needle shaft approaching in a medial to lateral-posterior direction towards the injection point (IP). B) posterior QLB, arrow indicates needle, which pierces through internal oblique (IO) and external oblique (EO) in its path to the posterior border of the QL. C) shamrock sign. D) intramuscular QLB, white arrow: needle trajectory, and white dotted line: spread of local anesthetic.
PC: Peritoneal cavity, IP: Injection point, QL: Quadratus lumborum muscle, PNF: Peri nephric fat, (S) local anesthetic solution

that adding DEX would reduce use by 25%, a total sample size of 40 individuals (20 in every group) was selected. To prevent dropout, we added five cases. Thus we enrolled 25 patients for each group.

5. Statistical analysis

The IBM Corp., Armonk, NY, USA, company SPSS v26 was utilized for the statistical study. For the same group, paired Student's t-tests were used for comparing quantitative data, while non-parametric Mann-Whitney tests were used for abnormally distributed parameters that are quantitative. Quantitative variables were presented as mean and standard deviation (SD) or median and range of interquartile ranges. Frequency and percentages (%) were utilized to illustrate qualitative characteristics. The Chi-square test was utilized to contrast the categorical data. Significant results were identified as two-tailed P values < 0.05.

6. Results

The study's participant flowchart follows the illustration of the consort flow in Figure 2.

The age and BMI of the patients were comparable across both groups. Table 1

A significant reduction existed in the total consumption of morphine across individuals in the first 24 hours after surgery in group B contrasted to group A. At 4 hours postoperative, there were no significant variations among both groups regarding the number of individuals who required morphine. Still, at eight, twelve, and twenty-four hours postoperatively, this number was significantly reduced in the B group. Individuals in group B noticed a considerable reduction in time to initial ambulation compared to those in group A. (P value < 0.001). Table 2

Preoperative, intraoperative, and (4, 8, 12, 24 hours) postoperatively recorded mean arterial blood pressure and heart rate were not substantially different among both groups. Table 3

At 4 hours following surgery, both groups had no substantial variations regarding postoperative NRS. However, at that point, the NRS in the B group was much less than that of the A group. Figure 3

There were no notable side effects related to the quadratus lumborum block. Regarding **DEX**-related side effects, 3 patients (12%) in the B group experienced bradycardia, and 2 (8%) experienced

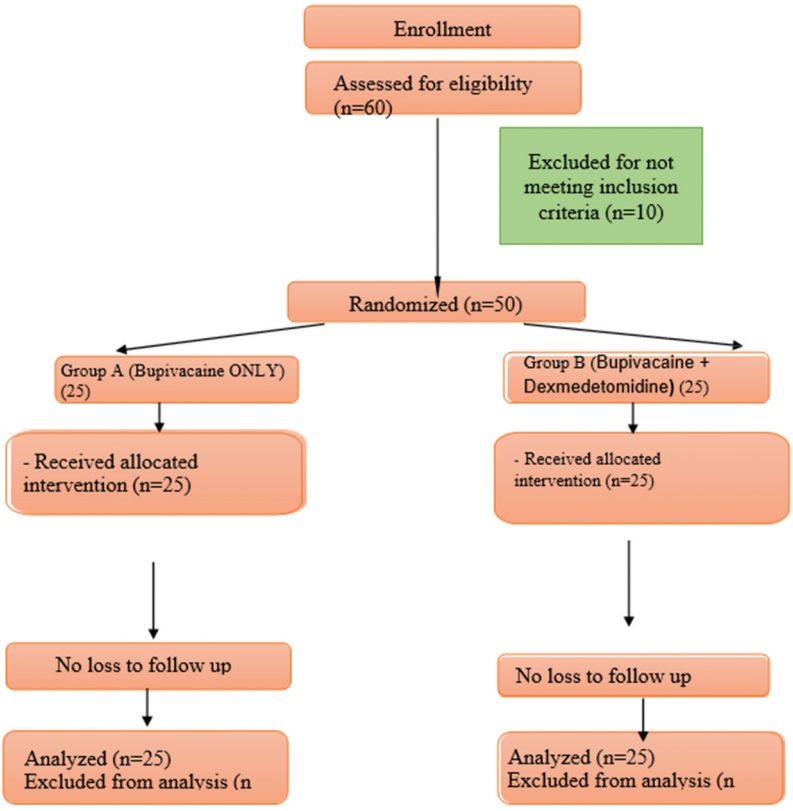

Figure 2. Consort flow diagram.

Table 1. Demographic data between both groups.

	GROUP A ($n = 25$) (Bupivacaine ONLY)	GROUP B ($n = 25$) (Bupivacaine + DEX)	P value
Age (years)	27.08 ± 5.84	27.00 ± 4.98	0.959
BMI	28.44 ± 3.48	28.24 ± 2.99	0.62

Data are presented as mean ± SD. BMI: Body mass index. p value < 0.005 is significantly different.

Table 2. Postoperative morphine and time to first ambulation.

	Group A ($n = 25$) (Bupivacaine only)	Group B ($n = 25$) (Bupivacaine+ DEX)	P value
No. of cases needed morphine at 4hrs postoperative	5(20.0%)	0	0.050
No. of cases needed morphine at 8hrs postoperative	14(56.0%)	1(4.0%)	<0.001*
No. of cases needed morphine at 12hrs postoperative	23(92.0%)	5(20.0%)	<0.001*
No. of cases needed morphine at 24hrs postoperative	25(100.0%)	14(56.0%)	<0.001*
Total morphine consumption in first 24 hrs. Postop	11.44 ± 3.97	5.39 ± 2.31	<0.001*
Time to first ambulation (hours)	4.12 ± 0.67	2.68 ± 0.63	<0.001*

Data are presented as mean ± SD or frequency (%). No: number p value < 0.005 is significantly different. *: Significant.

hypotension. Regarding the sedation score, there was no significant variation between the two groups. Table 4

7. Discussion

According to our outcomes, patients in group B who got QLB with bupivacaine and DEX had significantly less overall morphine use in the first 24 hours after surgery than patients in group A who only received QLB with bupivacaine. Additionally, group B had fewer individuals needing morphine postoperatively than group A.

Blanco et al.'s [6]outcomes, which revealed that the QLB after CS was effective and provided acceptable analgesia when combined with a usual postoperative analgesic regimen, supported our study. Further, After a cesarean delivery, Blanco et al. [8] discovered that QLB was better than TAP block because it resulted in a longer period of pain relief and less opiate use.

When conducting pyeloplasty surgery on young patients, Baidya et al. [13] reported that a single injection of trans-muscular QLB correlated to effective postoperative analgesia.

Bilateral intramuscular QLB has been connected to protracted postoperative analgesia in pediatric

Table 3. Mean arterial blood pressure and heart rate among the studied cases.

	GROUP A ($n = 25$) (Bupivacaine ONLY)	GROUP B ($n = 25$) (Bupivacaine + DEX)	P value
HR (beat/minute)			
Preoperative	98.88 ± 13.25	94.16 ± 15.99	0.261
Intraoperative	94.32 ± 17.53	93.28 ± 16.23	0.829
4 hrs. postoperative	79.00 ± 12.96	79.68 ± 11.29	0.844
8 hrs. postoperative	78.72 ± 6.79	79.52 ± 8.34	0.711
12 hrs. postoperative	79.44 ± 9.21	76.16 ± 6.09	0.144
24 hrs. postoperative	78.12 ± 8.02	76.80 ± 8.54	0.072
MBP (mm Hg)			
Preoperative	63.84 ± 9.42	64.52 ± 11.15	0.817
Intraoperative	63.16 ± 7.63	64.24 ± 11.06	0.690
4 hrs. postoperative	63.80 ± 9.27	61.92 ± 6.43	0.409
8 hrs. postoperative	67.20 ± 8.30	63.60 ± 6.21	0.089
12 hrs. postoperative	71.60 ± 7.74	67.36 ± 7.83	0.060
24 hrs. postoperative	68.00 ± 7.62	66.40 ± 7.97	0.068

Data are presented as mean ± SD. MBP: mean arterial blood pressure, HR: heart rate.

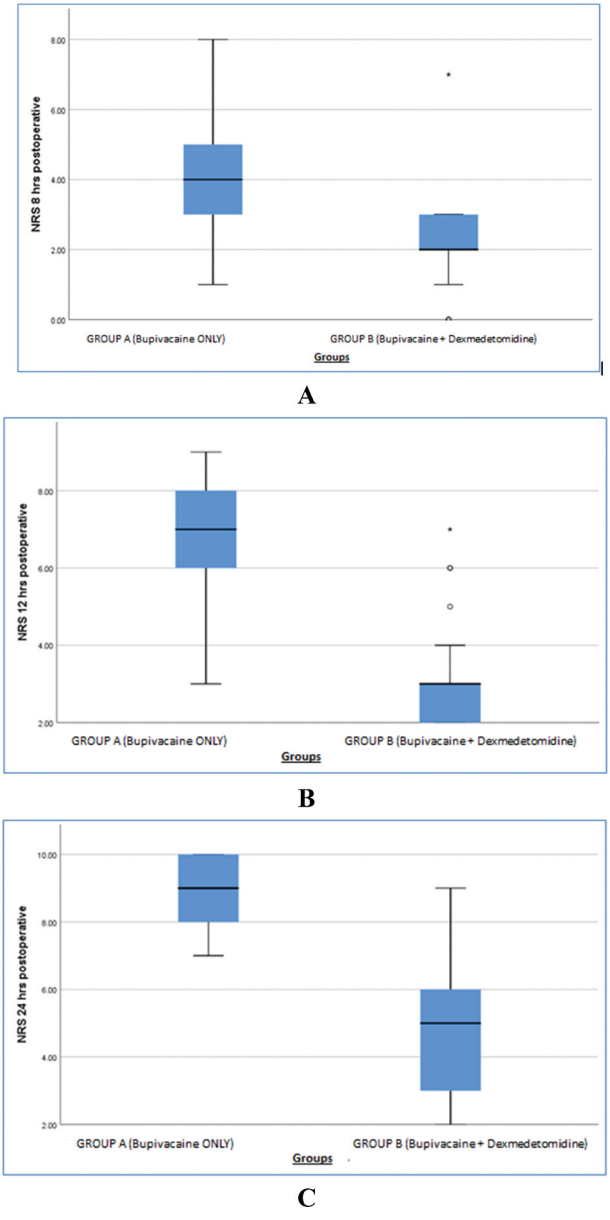

Figure 3. NRS at (A) 8 hrs, (B) 12 hrs and (C) 24 hrs postoperative.

patients after a laparoscopic appendectomy, according to the study of Murouchi et al.[14]

The results of the present study were comparable to those of a study conducted by Klç et al. [15] evaluating the effectiveness of QLB III for postoperative pain management PCNL. According to that studies, the control group's total postoperative morphine consumption was shown to be greater at the 4th, 8th, 12th, and 24th hours.

In the first 24 hours after kidney transplant surgery, there was a decrease in cumulative fentanyl use, according to research by Kolacz et al. [16], which is an advantage of the QLB type 2 over the TAPB.

Alansary et al.'s work [17], done on 80 cases randomly allocated into 2 equal groups received combined GA plus TiQLB, group dexmedetomidine-bupivacaine (DB) received 30 mL bupivacaine 0.25% plus 1 mu g/kg dexmedetomidine and group bupivacaine (B) received 30 mL bupivacaine 0.25% only. Its results revealed that patients in the DB group experienced lower total morphine consumption and lower VAS scores when compared with patients in the B group and ten minutes after the block there was a significant reduction in mean blood pressure and heart rate in the DB group than in the B group. This study supported our result due to, it was demonstrated that adding DEX to bupivacaine in TiQLB correlated with powerful and persistent postoperative analgesia with fewer postoperative side effects.

When contrasted with using IV DEX as a QLB adjuvant, Improved analgesia following surgery with less morphine intake, improved pain assessments, and a longer period before the first analgesic request were all made possible by adding DEX to QLB, according to a different study published by Abdellatif et al. [18] It also had fewer postoperative side effects.

Table 4. Side effects and sedation score.

		GROUP A ($n = 25$) (Bupivacaine ONLY)	GROUP B ($n = 25$) (Bupivacaine + DEX)	P value
QL-related bowel injury		0	0	-
QL-related hematoma formation		0	0	
QL-related nerve injury		0	0	
QL-related intravascular injection		0	0	
DEX related bradycardia		—	3(12.0%)	—
DEX related hypotension		—	2(8.0%)	
Sedation score (Itching)	None	21(84.0%)	22(88.0%)	0.33
	Mild	2(8.0%)	3(12.0%)	
	Moderate	2(8.0%)	0	
	Severe	0	0	
Sedation score (Nausea)	None	18(72.0%)	20(80.0%)	0.55
	Mild	6(24.0%)	5(20.0%)	
	Moderate	1(4.0%)	0	
	Severe	0	0	

Data are presented as frequency (%). QL: quadratus lumborum p value < 0.005 is significantly different.

The TAP block is another truncal block comparable; for abdominal procedures, the postoperative analgesia after TAP block with or without dexmedetomidine was studied. According to Sun et al.'s meta-analysis, DEX is a possible anesthetic adjuvant that, when combined with TAP block, may improve postoperative analgesia while reducing postoperative opioid consumption [12]

In our study determined that group A (DEX +Bupivacaine) had a longer median time for first analgesic dose (720 min) than group B (Bupivacaine only) (480 min). While Varshney et al.'s [11] study additionally determined that DEX with bupivacaine had a longer median duration for the first analgesic dosage (600 min) than bupivacaine alone (352.5 min), with no obvious adverse effects.

Our research showed no major variations in postoperative NRS between the two groups after 4 hours after surgery. However, at 8, 12, and 24 hours postoperatively, there was a substantial decrease in NRS in the B group compared to the A group. Our NRS results correspond with those from Yao et al. [19], who discovered that the NRS scores in groups D1 (perineural administration of DEX 0.5 µg/kg + intercostal nerve block with 0.5% ropivacaine) and D2 (intravenous infusion of DEX 0.5 µg/kg + intercostal nerve block with 0.5% ropivacaine) were substantially lower than those in group R (intercostal nerve block with 0.5% ropivacaine).

Following a meta-analysis by Sun et al. [17], who discovered that DEX + LA did not increase the risk of hypotension or bradycardia, there were not any substantial variations in preoperative, intraoperative, and postoperative hemodynamics (MBP and HR) between the two groups in the study we conducted. In contrast, Alansary et al. [17] discovered that patients in both groups demonstrated a reduction in MBP and HR 10 minutes after the block, followed by an improvement after 20 minutes.

This improvement continued postoperatively; in this study, they used a larger dose of DEX (1 µg/kg), which may cause hypotension and bradycardia. Also, Mohamed et al. [20] revealed a significant reduction in intraoperative HR and MBP in DEX groups.

Our study showed there was a significant decrease in time to first ambulation among patients in group B, while a study done by Chen et al. [21]included 57 reported that almost half the patients in the intramuscular QLB group haven't the ability to ambulate without support in first 24 hours postoperative.

This study delineates that, postoperative sedation scores within 24 hours showed no significant difference between the two groups. While Xiang et al. did a study [22], reported a significant increase in sedation score in DEX plus bupivacaine group compared to the bupivacaine-only group, this study differ from our study due to, different type of surgery with different age of the patients. In addition, Alansary et al. [17]showed that postoperative sedation scores within 24 hours were higher in the DEX plus bupivacaine group than in the bupivacaine-only group.

Our study had some limitation such as, we didn't provide patient-controlled analgesia to our patients, didn't assess the postoperative side effects of DEX beyond 24 hours, and the study was done in one center.

8. Conclusion

Following a cesarean section, ultrasound-guided QLB II offers effective immediate postoperative analgesia, and the addition of DEX to local anesthetics in the QL block increases the period of postoperative analgesia and without significant side effects.

Acknowledgments

There are none to be declared.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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