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Original Research Article

# Effect of dexmedetomidine as an adjuvant to bupivacaine in bilateral posterior quadratus lumborum block for postoperative analgesia after cesarean delivery: A prospective randomized double-blinded study

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ABSTRACT

**Background:** Effective pain control following a cesarean section was crucial. The postoperative discomfort following a cesarean section was treated using intravenous opioids and nonsteroidal anti-inflammatory medications. Currently, postoperative pain is alleviated through the utilization of fascial plane blocks such as the quadratus lumborum block, transversus abdominis plane block (TAP), erector spinae plane (ESP) blocks, and ilioinguinal nerve block.

**Aim & Objective:** The primary aim of this study was to assess the duration of initial pain relief and time to first rescue analgesia. Secondary objectives were total number of rescue analgesic doses and amount of rescue analgesic consumption and postoperative pain scores.

**Materials and Methods:** A total of 70 patients scheduled for elective lower segment cesarean sections were randomly assigned to either Group B or Group D. All cesarean sections were performed under spinal anesthesia. Participants in Group B received 0.4 ml/kg of a bupivacaine solution. In contrast, patients in Group D were administered a solution consisting of 0.4 ml/kg of 0.125% bupivacaine combined with 1 $\mu$g/kg of dexmedetomidine.

**Results:** The time to initial rescue analgesia was significantly longer in Group D (16.3 hours) compared to Group B (8.3 hours), with a p-value of <0.01. Similarly, the duration of analgesia was extended in Group D (16 hours) compared to Group B (8 hours), showing a statistically significant difference ($p < 0.01$). Group D required significantly fewer total rescue analgesic doses and fewer individuals required rescue analgesics. The mean total consumption of rescue analgesics, specifically paracetamol and tramadol, was markedly lower in Group D (0.14 gm of paracetamol and 2.8 mg of tramadol) compared to Group B (2.1 gm of paracetamol and 45.7 mg of tramadol), with a p-value of <0.01. Moreover, significant variations in pain scores were observed between 12 and 24 hours, with Group D participants exhibiting considerably lower pain scores than those in Group B. Additionally, from 8 to 24 hours, Group D patients demonstrated significantly reduced heart rates, as well as lower systolic and diastolic blood pressures compared to Group B.

**Conclusion:** The addition of dexmedetomidine to bupivacaine significantly prolongs the time for initial rescue analgesia, duration of analgesia and reduces the number of rescue analgesic doses and pain scores.



## 1. Introduction

The most prevalent surgical procedure performed on obstetric patients is lower segment cesarean section, and

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the incidence of this procedure has risen in recent years for a variety of surgical indications.[1] A distinguishing characteristic of cesarean sections over other surgical procedures is their impact on two individuals: the mother and her infant.[2] Insufficient management of postoperative pain results in delayed functional recovery and mobilization, as well as an elevated likelihood of thromboembolic complications.[3] Additionally, inadequate analgesic treatment is linked to chronic postoperative pain, peripartum depression, challenges in breastfeeding, and insufficient maternal-infant attachment.[4] Insufficient management of post-operative pain could potentially result in the development of post-traumatic stress disorder.[5] The administration of intrathecal adjuvants, such as opioids and $\alpha 2$ agonists like dexmedetomidine and clonidine, has traditionally resulted in dose-dependent adverse effects.[6,7] Epidural anesthesia, has been linked to problems such as dural puncture, vascular complications, challenges in certain cases in determining the epidural space, and difficulty in emergencies such as antepartum haemorrhage, eclampsia, etc. Other methods like intravenous non-steroidal anti-inflammatory medicines (NSAIDs), which can affect the kidney, liver, and gastrointestinal tract. Intravenous opioid use is associated with post-op nausea, vomiting sedation, and prone for opioid addiction). The advancement of novel abdominal wall fascial plane blocks, such as the quadratus lumborum block (QL), and transverse abdominis plane block (TAP), has led to the efficient treatment of postoperative pain.[8,9] Although dexmedetomidine has been extensively documented in prolonging the duration of analgesia in other fascial plane blocks, including erector spinae plane blocks, studies regarding its application in QL blocks with bupivacaine are limited.[10,11] A study by Benedicta et al. reported QL block with low-dose bupivacaine had a longer duration of analgesia.[12] Considering the limited amount of literature on the use of dexmedetomidine with bupivacaine in QL block, we planned to evaluate the efficacy of low dose 0.125% to 0.2% bupivacaine in a quadratus lumborum (QL) block, with and without dexmedetomidine.

## 2. Materials and Methods

### *2.1. Design*

The study was a prospective double-blind randomized trial conducted to evaluate the analgesic efficacy of combining bupivacaine with dexmedetomidine compared to using bupivacaine alone in individuals undergoing cesarean delivery.

### *2.2. Setting*

This study was conducted in the Department of Anaesthesiology in a tertiary care hospital from September 2020 to May 2021. This study was approved by the institutional ethical committee (IEC/19/NOV/155/69) and the clinical trial registry of our nation (CTRI/2020/09/027583).

### *2.3. Recruitment of subjects*

All study participants were recruited following the acquisition of written and informed consent. The study participants were provided with information regarding the available postoperative analgesic choices. All pregnant female patients in the American Society of Anaesthesiologists physical status 2 (ASA-PS II) who were between the ages of 18 and 45 and had an elective lower segment cesarean delivery under spinal anesthesia were included in our study. The study excluded individuals who had a BMI (body mass index) higher than 32 kg/m2, a confirmed allergy to local anesthetics, issues with blood clotting, refusal to give informed consent, or an infection or pain sensation at the location where the block was given. The study enrolled a cohort of 80 patients (Diagram 1). Among these, a total of 7 patients were excluded from the study (4 patients' consent not given,3 patients spinal effect weaned off), resulting in a remaining sample of 73 patients who were randomly allocated to either Group B (Bupivacaine) or Group D. (Bupivacaine with dexmedetomidine) (Diagram 1). The randomization of all study participants was conducted using computer-generated block randomization. One participant from Group B and two participants from Group D were excluded owing to challenges in implementing the block (Diagram 1). The primary objectives evaluated were the time to administer initial rescue analgesia and the time to initial VAS score 4. The secondary outcome of the study was the total number of rescue analgesia doses supplied for 24 hours. we also assessed the amount of rescue analgesic consumed and the pain scores reported by patients after surgery. All patients were given intravenous (IV) metoclopramide 10 mg and pantoprazole 40 mg 30 minutes before the surgery on the day of the procedure. Following their transfer to the operating room, a pulse oximeter, electrocardiogram, and non-invasive blood pressure monitors were connected. The study participants were administered oxygen at a rate of 6 liters per minute using Hudson masks. The study participants received spinal anesthetic in a sitting position, specifically at the 3rd and 4th lumbar intervertebral area. This was administered using a 27-gauge Pencan needle, with a dosage of 10 mg of hyperbaric bupivacaine. Following the administration of spinal anesthesia, all parturients were positioned in a supine posture with a 20-degree left uterine tilt. Before the surgical incision, all the participants in the study achieved a satisfactory level of sensory blockade extending to the T4-T6 dermatomal level. During the surgery, intravenous fluids such as crystalloids, intravenous ephedrine, and phenylephrine were provided to treat hypotension based on the patient's clinical condition.

According to the institutional protocol, all study participants were administered a dosage of 20 units of oxytocin as 3 IU bolus over 3 min followed by 8 IU /hr as an infusion for 2 hrs. At the end of the surgical procedure, 1 gram of intravenous acetaminophen was given to all participants.

The initial vital measurements before the QL block, such as heart rate, non-invasive blood pressure, and oxygen saturation were documented, and the pain level was evaluated using a visual analog scale. Before the QL block, all participants in the study had sensory blockade that extended to the T8 to T10 dermatomal level. Participants were excluded if they had pain at the QL block administered site. Every study participant was blinded to the drugs that were administered to them. In the drug preparation room sealed envelope was opened by a different anaesthesiologist not involved in the study and he loaded the study drugs as per allocation. Study participants were positioned in a lateral posture and equipped with monitors, after which the administration of quadratus lumborum block 2 (QL2) was conducted with strict adherence to aseptic protocols. The QL block was administered before the patient's onset of postoperative pain or pain during the block process. The curvilinear transducer, with a frequency range of 5-2 MHz, (C60X) was positioned in the transverse plane on the lateral aspect of the patient's body, at the level of the umbilicus and cranial to the iliac crest, with the patient in a lateral posture. This was performed by utilizing a bedside ultrasound device produced by Sonosite, Inc. headquartered in Bothell, WA, 98021 USA. The muscle divisions of the abdominal wall were identified. Following that, the transducer that was used was moved posteriorly so that the aponeurosis associated with the transverse abdominis muscle could be visually represented. Subsequently, the transducer probe was moved posteriorly until the lumbar interfascial triangle, which comprises the paraspinal muscle located between the quadratus lumborum and latissimus dorsi muscles, was identified. Ultrasound-guided blocks were done by 3 experienced anesthesiologists with more than 10 years of experience in ultrasound-guided nerve blocks or fascial plane blocks. An A B Braun Stimuplex 20 G 100 mm needle (manufactured by Braun in Melsungen, Germany) was inserted in a parallel direction to the ultrasonic guidance, penetrating through the layers of the abdominal wall. The needle was meticulously placed into the transversus aponeurosis to locate the posterior side of the quadratus lumborum (QL) muscle (Figure 1). Subsequently, the needle tip was placed into the posterior side of the QL muscle, and a volume of 5 ml of saline solution with a concentration of 0.9 percent was given to verify the precise placement of the needle as well as facilitate the observation of the dispersion pattern of the solution. The local anesthetic solution was administered in the lumbar inter-fascial triangle located posterior to the quadratus lumborum muscle. Previous studies that use a bupivacaine or levobupivacaine concentration of 0.25 percent in QL blocks documented a reduction in lower limb mobility.[13,14] Although the transmuscular or anterior QL block had consistent spread to the lumbar plexus and paravertebral space, the incidence of motor weakness was higher with QL3 than with QL 2 block.[15] In Group B patients' local anesthetic solution was prepared with 2mg/kg of bupivacaine diluted up to 60 ml with normal saline. Group B patients received a dose of 0.125 to 0.2% bupivacaine (30 ml on each side). Patients in Group D were given a dose of 0.125%-0.2% Bupivacaine together with 0.5 $\mu$g per kg of dexmedetomidine on each side (total 1mcg/kg) without exceeding the toxic dose of 2 mg per kg of bupivacaine (30 ml on each side). The administration of this anesthetic solution occurred after aspiration, with increments of 4ml being injected. After the procedure was completed, individuals were transferred to a post-anesthesia care unit, where their oxygen saturation levels, non-invasive blood pressure, and heart rate were closely monitored for 2 hours. Post anesthesia care unit (PACU) anesthesiologists and PACU nurses, and postoperative ward nurses who were all blinded to the assignment recorded the intensity of postoperative pain for all the delivered mothers using a VAS score (0 = no pain and 10 = worst possible pain) at various specified time intervals (0min, 30mins, 1hr, 2, 4, 8, 12, 16, 20 and 24hrs). The 'time for first analgesic requirement' was recorded, with 'Time 0' being the completion of the block process. The time to VAS score of 4 or more than 4 was recorded. Intravenous acetaminophen as a rescue analgesia was given when the VAS score was 4 or more than 4. Patients who complained of pain within 6 hours after rescue acetaminophen injection were given intravenous tramadol 50 mg as a second rescue analgesic for postoperative pain. For each patient, the total number of analgesic dosages consumed in the first 24 hours was calculated. The study drugs were loaded in 20 ml syringes in a sterile manner and kept in a block tray.

### *2.4. Sample size calculation*

The primary outcome for determining the sample size was the time to the first requirement of morphine, based on the previous study by Mieszkowski et al.[8] The sample size was calculated using nMaster software, with an observed difference of 390 minutes, a standard deviation of 120 minutes, an effect size of 0.75, and a superiority margin of 300 minutes. To achieve a power of 90% and maintain an alpha error rate of 5%, the study required a sample size of 60 female participants aged 18-45 years, all of whom were undergoing elective cesarean delivery with an ASA physical status score of 2. Considering potential exclusions, we increased the sample size to 70 patients, with 35 assigned to each group, allowing for a 10% dropout rate. Although the calculated sample size was 70, we included 80 participants in the study to further account for any unforeseen dropouts

(Diagram 1).

### 2.5. Statistical analysis

The data was analysed using SPSS version 23.0 (IBM Corp.). Categorical variables were described using frequency and percentage analyses. The Shapiro-Wilk test was used to assess the normality of the data. For normally distributed continuous variables, the mean and standard deviation were reported, while the median and interquartile range were used for non-normally distributed variables. An unpaired sample t-test was applied to compare normally distributed variables, and the Mann-Whitney U test was used for non-normally distributed variables. The chi-square test assessed the statistical significance of categorical data.

For pain scores and hemodynamic parameters (heart rate, systolic and diastolic blood pressure), repeated measures ANOVA was used to determine p-values within and across groups. Bonferroni correction was applied to adjust for multiple comparisons. A p-value of <0.05 was considered statistically significant for all analyses.

## 3. Results

Group B and Group D exhibited similar demographic characteristics, including body mass index (BMI) and age. (Table 1). The administration of first rescue analgesics for breakthrough pain with intravenous acetaminophen took significantly longer in Group D (16.3 hours) compared to Group B (8.3 hours) (P <0.01) (Table 2). The time to initial onset of VAS score 4 was also significantly longer in Group D than in Group B (Table 2). Furthermore, it was observed that Group D (0.14gm) consumed a mean dose of paracetamol, a rescue analgesic, at a lower level than Group B (2.1gm) (Table 2). We also noted that postoperative tramadol consumption was significantly higher in Group B (45.7 mg) than in Group D (2.8mg). In terms of pain scores, there was no significant difference for the first eight hours (Graph 1). A statistically significant reduction in visual analog scale (VAS) scores was observed in Group D relative to Group B within the 12- to 24-hour postoperative period (Table 3). Group B individuals exhibited comparatively lower pain scores (median <4), despite a statistically significant rise in pain scores from 12 to 24 hours (Table 3). Systolic and diastolic blood pressure and heart rate were similar in the two groups from baseline to eight hours postoperatively (Graphs 2, 3 and 4). A significant reduction in heart rate and systolic blood pressure was observed in Group D patients from 8 to 24 hours postoperatively, with a large effect size, in comparison to Group B (P <0.01) (Tables 4 and 5). We also noticed that Group D patients had lower diastolic blood pressures from 8 to 24 hours after surgery, with a moderate effect size (Table 6). In this study, hypotension was observed in three patients in the dexmedetomidine group and one patient in the bupivacaine group within one hour (Table 7). These patients were treated with a 6 mg bolus of ephedrine. Additionally, we observed that two patients in the dexmedetomidine group had bradycardia (Table 7 ). We did not observe any adverse events, hypotension, or bradycardia, dry mouth in the postoperative period after one hour.

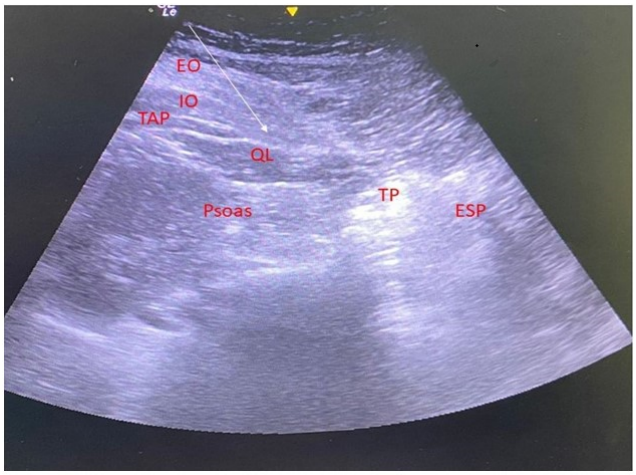
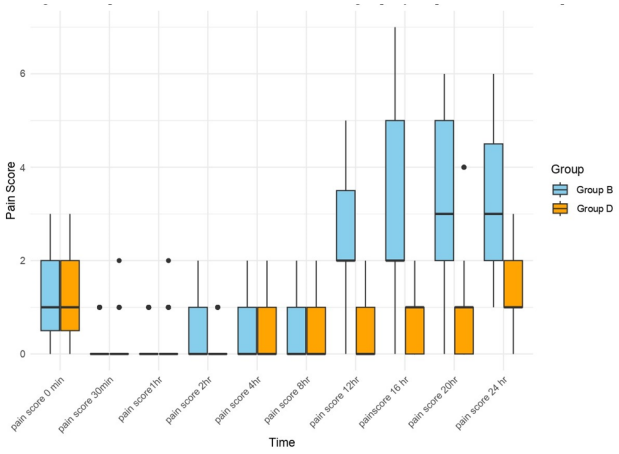



**Figure 1:** Posterior QL block




Graph 1: Comparison of median pain scores between the groups by boxplots at different time points

## 4. Discussion

In our study, both groups were comparable in body mass index and age (Table 1). We experienced difficulties while executing the block procedure in three patients who had a body mass index (BMI) exceeding 30 (Diagram 1). In our study Group D exhibited a significantly longer duration of pain relief (16.3 h) before the administration of initial rescue analgesics, as compared to Group B (8.3 h) (Table 2).Yousef et al. similarly observed a longer duration of pain relief in the QL block up to 15.1 h.[16] Similarly, A study

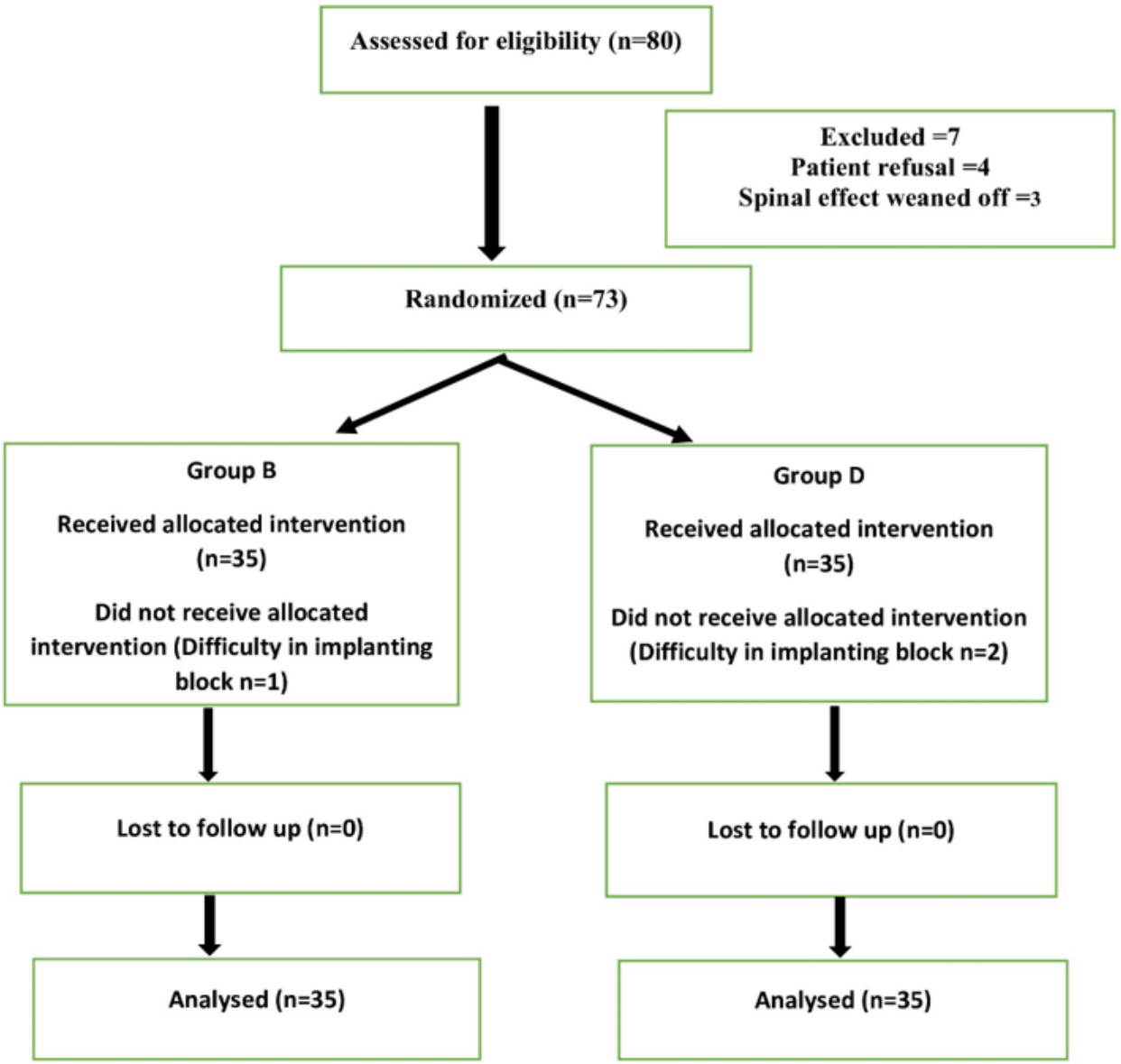



Diagram 1: Consort flow diagram

**Table 1:** Comparison of demographic characteristics between two groups

| | Group B | Group D | P value |
|---|---|---|---|
| Age in years (Mean± SD) | 26.2 ± 4.5 | 27.2± 4.4 | 0.34 |
| BMI (Mean± SD) | 29.6 ±1.7 | 28.8 ± 1.9 | 0.06 |
| Mean surgical duration in min (Mean± SD) | 99.5 ± 4.3 | 100.4 ± 6.2 | 0.49 |

An unpaired t-test was used to compare the differences between both groups.

**Table 2:** Comparison of postoperative data between both groups

| | Group B | Group D | P value | Effect size (Cohen's d) | Mean difference(95% Confidence intervals of difference Lower, Upper) |
|---|---|---|---|---|---|
| Time to $1^{st}$ rescue analgesia in h (mean± SD) | 8.3 ± 1.1 | 16.3 ± 2.7 | <0.01* | -3.8 | 8 (- 8.96, -7.01) |
| Time to the initial onset of VAS 4 in h (mean± SD) | 8.0 ± 1.1 | 16 ± 2.7 | <0.01* | -3.8 | 8 (-8.98, -7.02) |
| Mean dose of rescue analgesic (Acetaminophen) consumption in grams (mean± SD) | 2.1±0.69 | 0.14±0.49 | <0.01* | 3.27 | 1.96 (1.67,2.24) |
| Mean dose of Tramadol consumption in mg (number of patients tramadol used) (mean± SD) | 45.7 ± 32.9 (26) | 2.8 ± 11.7 (2) | <0.01* | 1.73 | 42.9 (31.12, 54.67) |
| Number of participants requiring rescue analgesia | 35 | 3 | <0.01* | | |
| Requirement of rescue analgesic doses in 24 h 0 dose 1 dose 2 doses 3 doses | 0 6 18 11 | 32 1 2 0 | <0.01* | | |

*Indicates p-value was significant between both groups. Unpaired t-test and chi-square test was used to compare the differences between the groups.

**Table 3:** Comparison of pain scores between both groups

| VAS scores | Group B | Group D | P value-Mann Whitney u test | F value | RM ANOVA p value between the groups | Partial eta squared ($\eta$p2) |
|---|---|---|---|---|---|---|
| Baseline Median (Q1-Q3) | 1(0.5-2) | 1 (0.5-2) | 0.92 | | | |
| At 30 min Median (Q1-Q3) | 0(0-0) | 0(0-0) | 0.95 | | | |
| 1 hour Median (Q1-Q3) | 0(0-0) | 0(0-0) | 0.82 | | | |
| 2 hours Median (Q1-Q3) | 0(0-1) | 0(0-0) | 0.13 | 22.29 | <0.01* | 0.59 |
| 4 hours Median (Q1-Q3) | 0(0-1) | 0(0-1) | 0.17 | | | |
| 8 hours Median (Q1-Q3) | 0(0-1) | 0(0-1) | 0.17 | | | |
| 12 hours Median (Q1-Q3) | 2(2-4) | 0(0-1) | <0.01* | | | |
| 16 hours Median (Q1-Q3) | 2(2-5) | 1(0-1) | <0.01* | | | |
| 20 hours Median(Q1-Q3) | 3(2-5) | 1(0-1) | <0.01* | | | |
| 24 hours Median (Q1-Q3) | 2(2-4.5) | 1(1-2) | <0.01* | | | |
| P value within the groups | <0.01* | <0.01* | | | | |

*Indicates p-value was significant.
Repeated measures of ANOVA were used to compare the difference between the groups and with in the groups at different time points. Partial eta squared indicates magnitude of effect size was large (>0.14)

conducted by Stoper-Pintaric et al. showed a significant increase in the time for the first request for analgesia in QL block, with a duration of up to 11 h.[17] Mieszkowski et al. in their study showed that the time from cesarean section to the first dose of morphine requirement was 618 min in type 1 QL block.[8] Salama et al. in their study reported that the time to $1^{st}$ morphine requirement was 17 h after bilateral QL block in cesarean section.[18] Hansen et al. also reported that transmuscular QL block prolongs the duration of analgesia up to 5.3 h.[19] Furthermore, Jin et al. conducted a systematic review and meta-analysis that corroborated these findings, suggesting that the QL block was related to an extended duration of analgesia (in terms of $1^{st}$ request for analgesia) in cesarean section procedures.[20] We found that the time it took for the VAS score to reach 4 was considerably longer in Group D patients (16 h) compared to Group B patients (8 h). The increased duration for postoperative VAS score 4 and time to first request for analgesia with dexmedetomidine in QL block may be due to action at the peripheral level, spinal and supraspinal levels.

**Table 4:** Comparison of heart rate between the groups

| Heart rate | Group B (Mean± SD) | Group D (Mean± SD) | F value | P value between the groups | Partial eta squared ($\eta$p2) |
|---|---|---|---|---|---|
| 0 min (Baseline) | 86.9 ±9.3 | 83.7 ± 8.5 | | | |
| 30 min | 84.3±7.4 | 81.2±7.8 | | | |
| 1 hour | 80.1±8.4 | 77.1±9.1 | | | |
| 2 hours | 79.2±8.5 | 76.1±7.3 | | | |
| 4 hours | 80.7±9.4 | 75.3±7.7 | 30.19 | <0.01* | $\eta$p2 =0.49 |
| 8 hours | 97±8.8 | 73.8±7.4 | | | |
| 12 hours | 89.9±9.7 | 72.5±6.3 | | | |
| 16 hours | 94.2±10.1 | 73.1±7.5 | | | |
| 20 hours | 92.9±10.5 | 74.7±10.9 | | | |
| 24 hours | 93.7±10.4 | 74.1±10.2 | | | |
| P value within the groups | <0.01* | <0.01* | | | |

Repeated measures of ANOVA were used to compare the difference between the groups and with in the groups at different time points. *Indicates p-value was significant. Partial eta squared value indicates magnitude of effect size was large (>0.14)

**Table 5:** Comparison of Systolic blood pressure (SBP) between the groups

| Systolic blood pressure | Group B (Mean± SD) | Group D (Mean± SD) | F value | P value between the groups | Partial eta squared |
|---|---|---|---|---|---|
| 0 min(baseline) | 114.4±9.1 | 113.8±9.4 | | | |
| 30 min | 111.5±7.1 | 111.5±7.6 | | | |
| 1 hour | 110.5±7.2 | 109.6±8.2 | | | |
| 2 hours | 111±8.2 | 109.4±7 | | | |
| 4 hours | 110.7±7.7 | 109.3±7.4 | | | |
| 8 hours | 121.3±8.7 | 108.3±6.8 | 21.35 | <0.01* | $\eta$p2=0.23 |
| 12 hours | 116.8±7.7 | 108±6.2 | | | |
| 16 hours | 119.8±8.3 | 106.4±6.8 | | | |
| 20 hours | 118.1±8.1 | 106±7.5 | | | |
| 24 hours | 119.7±9.9 | 106.2±8.2 | | | |
| P value within the groups | <0.01* | <0.01* | | | |

Repeated measures of ANOVA were used to compare the difference between the groups and with in the groups at different time points. *Indicates p-value was significant. Partial eta squared value indicates magnitude of effect size was large (>0.14)

**Table 6:** Comparison of diastolic blood pressure between the groups

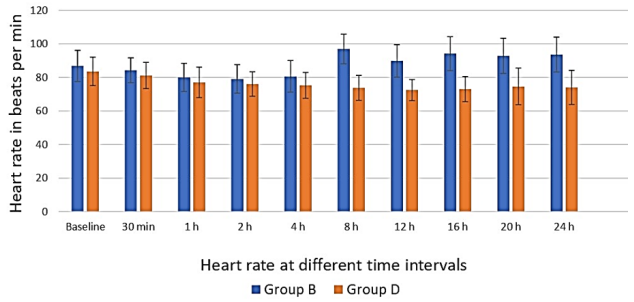
| Diastolic blood pressure | Group B (Mean± SD) | Group D (Mean± SD) | F value | P value between the groups | Partial eta squared |
|---|---|---|---|---|---|
| 0 min (baseline) | 70.1±7.9 | 69.5±9.1 | | | |
| 30 min | 68.9±7.6 | 67.9±7.5 | | | |
| 1 hour | 67.4±7.4 | 66.7±7.2 | | | |
| 2 hours | 66.3±5.8 | 65.7±5.8 | | | |
| 4 hours | 66.1±6.8 | 65.2±5.3 | 9.71 | <0.01* | $\eta$p2=0.10 |
| 8 hours | 71.2±7.6 | 63.9±5.2 | | | |
| 12 hours | 68.7±6.3 | 63.2±5.5 | | | |
| 16 hours | 69.6±6.6 | 63.2±5.4 | | | |
| 20 hours | 69.1±7.2 | 63±5.2 | | | |
| 24 hours | 69.4±6.3 | 62.6±5.1 | | | |
| P value with in the groups | <0.01* | <0.01* | | | |

Repeated measures of ANOVA were used to compare the difference between the groups and within the groups at different time points. *Indicates p-value was significant. Partial eta squared value indicates magnitude of effect size was moderate (>0.06 and <0.14).

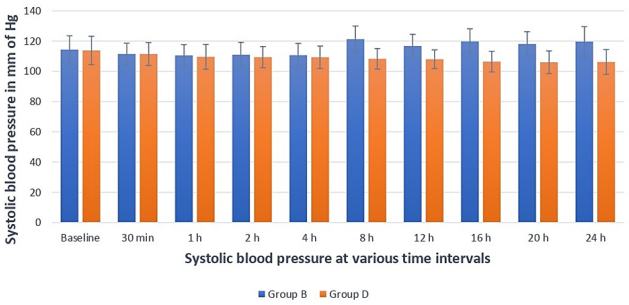
**Table 7:** Comparison of adverse effects between both groups

| Adverse events | Group B (Adverse events/Number of patients in group) | Group D (Adverse events/Number of patients in group) | P value |
|---|---|---|---|
| Hypotension | 1 /35 | 3/35 | 0.30 |
| Bradycardia | 1/35 | 2/35 | 0.55 |

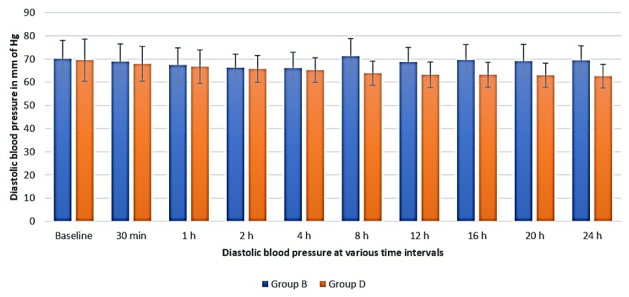
Chi square test was used to compare the difference between the groups




Graph 2: Heart rate comparison between both the groups




Graph 3: Systolic blood pressure comparison between both the groups




Graph 4: Diastolic blood pressure comparison between both the groups

The peripheral level action may be due to dexmedetomidine has an inhibitory effect on delayed rectifier K + current and Na + current, leading to a decrease in neuronal activity. The impact appears to be more prominent in C fibers, which are associated with pain, compared to A fibers, which are involved in motor function.[21] The spinal level action of dexmedetomidine may be attributed to its diffusion to the paravertebral space and its effects via binding to $\alpha 2$ receptors in the spinal dorsal horn, which results in a reduction of the release and reuptake of excitatory neurotransmitters, including glutamate and substance P. The transmission of pain signals in the ascending spinal route is suppressed by hyperpolarized interneurons, which leads to pain relief. The supraspinal level action was a result of its systemic absorption into the cerebrospinal fluid and its action on the $\alpha 2$A, $\alpha 2$B, and $\alpha 2$C receptors in the medulla. This resulted in a reduction of the descending noradrenergic pathway in the medulla or a reduction in the sympathetic nerve signals, thereby achieving the analgesic effect at the central level.

In our study Pain scores were comparable up to 8 hours. Blanco and colleagues also demonstrated lesser VAS scores during rest and dynamic (movement)periods, except for a 24-hour rest period, during which there was no discernible variation between the QL block group and the control group.[9] Similarly, Krohg et al. also observed reduced pain scores in the QL block group in comparison to the control group.[22] Stopar pintaric et al. also reported that pain scores were lower in QL block group.[17] Salama et al. similarly observed reduced pain scores in the QL block group compared to both the control group and the intrathecal morphine group.[18] In contrast, Tamura et al. reported no significant difference between spinal anesthesia with intrathecal morphine and spinal anesthesia along with QL block.[23] Group D patients in this study necessitated a reduced quantity of rescue analgesic boluses in comparison to Group B patients (Table 2). Krohg et al. also demonstrated that QL block with ropivacaine decreases ketobemidone consumption over 24 hours in comparison to the control group.[22] Similarly, Mieszkowski et al. found that the consumption of morphine at four-hour intervals decreased substantially in the QL block group compared to the control group.[8] Blanco et al. also observed that the QL block group had lower morphine consumption for 12 hours compared to the placebo group.[9] In contrast to our results, Irwin et al. did not detect significant disparities in morphine

intake between the sham block group and the QL block group.[24] This may be the result of intrathecal morphine and bupivacaine being administered during cesarean delivery. In the same way, Stopar Pinatric et al. demonstrated that the wound infiltration group exhibited a higher 24-hour piritramide consumption than the QL block group.[17] None of the study participants experienced any form of lower limb weakness in this study. The possible cause for this could be the decrease in the bupivacaine concentration to 0.125%-0.2% in both groups. The current study found no statistically significant difference in heart rate between the two groups during a period of up to 2 hours. Group D had a significant reduction in heart rate from 4 hours to 24 hours, in comparison to Group B (Graph 2). In contrast to our study Marhofer et al. noted that no significant difference in heart rate between ropivacaine, dexmedetomidine group, and ropivacaine alone group this may be due to low dose (20 $\mu$g) dexmedetomidine.[25] Elbeialy et al. also observed a lower heart rate in the bupivacaine and dexmedetomidine group than the bupivacaine alone group from 10 minutes after the block to 30 min in the postoperative period.[26] The present study found that Group D had a reduction in both systolic and diastolic pressures from 8 to 24 hours (Graphs 3 and 4). Elbeialy et al. also observed reduced mean arterial pressures in the group receiving bupivacaine dexmedetomidine compared to the group receiving bupivacaine alone after trans incisional ultrasound-guided QL block.[26] Clinically, the addition of dexmedetomidine to the QL block improves patient comfort by prolonging the duration of analgesia and reducing the need for repeated rescue analgesic doses. These effects are observed without any clinically significant changes in hemodynamic parameters.

## 5. Limitations

Our study did not include intrathecal opioids, which are commonly used in some regions. This omission may affect the generalizability of our findings, as there are conflicting reports in the literature comparing the quadratus lumborum (QL) block to standard intrathecal morphine.[27] Additionally, future research could benefit from comparing traditional intrathecal opioids with dexmedetomidine in fascial plane blocks like the QL block to better understand their relative efficacy. Another potential limitation is our analgesic protocol, which involved using two different rescue analgesic drugs. Future studies might explore the use of intravenous acetaminophen as a scheduled analgesic and tramadol as a rescue analgesic to streamline postoperative pain management.

## 6. Conclusion

Dexmedetomidine in a quadratus lumborum (QL) block for patients undergoing lower segment caesarean section significantly extends the duration before the initial onset of pain and the time before the first rescue analgesia is needed. Dexmedetomidine in QL block significantly decreases the total number of rescue analgesic doses and the amount of rescue analgesia needed. Furthermore, incorporating dexmedetomidine in the QL block leads to reduced pain scores after surgery when compared to using bupivacaine alone. These findings indicate that dexmedetomidine improves the effectiveness of the QL block, leading to better outcomes in the postoperative period.

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## 8. Conflict of Interest

None.

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