Comparison of Levobupivacaine and Levobupivacaine with Dexmedetomidine in Infraumbilical Surgeries Under Spinal Anesthesia

Amar Parkash Kataria, Vishal Jarewal, Rajan Kumar, Ankush Kashyap
Department of Anaesthesia, Government Medical College, Amritsar, Punjab, India

Abstract

Introduction: Spinal anesthesia is a widely used technique providing faster onset with effective and uniformly distributed sensory and motor block. Due to decreased cardiovascular and central nervous system toxicity, levobupivacaine is a good alternative for spinal anesthesia. Dexmedetomidine when used intrathecally is associated with prolonged motor and sensory block, hemodynamic stability, and less requirement of rescue analgesia in 24 h. Materials and Methods: A prospective, randomized study was carried out which included 60 adult patients between the age group of 20 and 65 years of physical status American Society of Anesthesiologists Classes I and II who underwent infraumbilical surgeries. Group L patients received 3 ml (15 mg) of 0.5% isobaric levobupivacaine + 0.3 ml normal saline while Group LD patients received 3 ml (15 mg) of 0.5% isobaric levobupivacaine + 0.3 ml (3 µg) dexmedetomidine. The two groups were compared with respect to the onset and duration of sensory and motor block and hemodynamic stability. Results: The mean duration of sensory block in Group L was 199.50 ± 7.96 min while in Group LD was 340.20 ± 11.78 min. All the differences were statistically highly significant between the two groups (P < 0.001). Mean duration of motor block in Group L and LD was 150.83 ± 9.17 min and 190.20 ± 9.61 min, respectively. Both the differences were highly significant (P < 0.001). Conclusion: It is concluded that Group LD has early-onset and prolonged duration of sensory and motor block and longer duration of postoperative analgesia than Group L.

Keywords: Dexmedetomidine, levobupivacaine, spinal anesthesia

INTRODUCTION

Effective postoperative pain control is an essential component of the care of the surgical patient. Inadequate pain control may result in increased morbidity or mortality.[1] Today’s anesthesiologist is not only involved in the preoperative and intraoperative care of the patients but is also responsible for the postoperative pain relief.[2] As we are moving ahead in time, there is renewed interest in the use of regional anesthesia techniques for a number of common surgeries replacing the general anesthesia.[3]

Regional anesthesia has many benefits over general anesthesia as it eliminates the pain both intraoperatively and postoperatively, provides excellent muscle relaxation, and reduces intraoperative bleeding.[4] Regional anesthesia techniques are also superior to systemic opioid agents with regard to analgesia profile and adverse effects.[5] Spinal anesthesia is the most commonly used technique due to its unmatchable reliability, simplicity, and cost-effectiveness. It provides a fast and effective onset of sensory and motor block, excellent muscle relaxation, and prolonged postoperative analgesia.[6] Due to decreased cardiovascular and central nervous system toxicity, levobupivacaine is a good alternative.[7]

In an attempt to further minimize the effects of local anesthetics and prolong the duration of intraoperative and postoperative analgesia, various adjuvants such as vasoconstrictors, alpha-2 agonists, and opioids have been used.[6] Dexmedetomidine is used as an adjuvant in spinal

Address for correspondence: Dr. Rajan Kumar,
Department of Anaesthesia, Government Medical College,
Amritsar - 143 001, Punjab, India.
E-mail: rajan.verma0102@gmail.com

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anesthesia and is associated with prolonged motor and sensory block, hemodynamic stability, and less requirement of rescue analgesia in 24 h as a result it facilitates reduction in dose of local anesthetic.[9] Hence, we present a study in which we have compared 0.5% isobaric levobupivacaine 15 mg (3 ml) and 0.5% isobaric levobupivacaine 15 mg (3 ml) with 0.3 ml (3 µg) dexmedetomidine in infraumbilical surgeries under spinal anesthesia.

The aims and objectives of the present study were to compare the efficacy of drugs used, onset and duration of sensory and motor block, hemodynamic changes, postoperative analgesia, side effects, and complications.

**Materials and Methods**

After obtaining approval from the Institutional Ethics Committee of our institution, this randomized double-blind study was conducted on sixty patients in the age group of 20–65 years of either sex of physical status American Society of Anesthesiologists (ASA) Classes I and II admitted for elective infraumbilical surgeries under spinal anesthesia. An informed and written consent was obtained from all the patients. The patients were randomly divided into two groups Group L and Group LD of 30 each. Group L patients received 3 ml (15 mg) of 0.5% isobaric levobupivacaine + 0.3 ml normal saline, whereas Group LD patients received 3 ml (15 mg) of 0.5% isobaric levobupivacaine + 0.3 ml (3 µg) dexmedetomidine.

The volume of the drug was kept constant (3.3 ml) in both the groups to avoid bias in the study. Anesthesiologist performing the intrathecal block was also blinded to study drugs as the drugs were prepared by another anesthesiologist. Patients who refused to undergo procedure, who were pregnant or lactating or with some coagulating/ neurological disorders or with spine injury or previous spine surgery or sepsis over spine or with morbid obesity or allergy to study drugs or with any life threatening diseases were excluded from study.

Visual analog scale (VAS) with 0–10 cm line was used to determine the level of analgesia in the postoperative period for 24 h and was explained to the patient a day before surgery during the preanesthetic checkup. The first end mark “0” means “no pain” and the end marked “10” means “severe pain.” Rescue analgesia was given if VAS score >3.

Premedication was done with injection glycopyrrolate 0.02 mg/kg by intravenous route 45 min before surgery and injection midazolam 0.04 mg/kg by intravenous route only before the procedure in both the groups. Preoperative pulse rate, heart rate, respiratory rate, noninvasive systolic and diastolic blood pressure, and saturation of oxygen of all the patients were recorded. After securing an intravenous line with 18G intracath, all patients were preloaded with 10 ml/kg of Ringer’s lactate solution over 15–20 min.

Under strict sterile conditions and after proper cleaning and draping the patient lying in left decubitus position, L3 and L4 space was located (in case of difficulty L2 and L3 space). Skin wheal was raised with 2% lignocaine and a Quincke spinal needle of 25G or 26G was used for spinal anesthesia. After verifying the free flow of cerebrospinal fluid (CSF), study drug was injected into the CSF which was prepared by another investigator to facilitate double blinding.

Oxygen was given at the rate of 5–6 L/min through a face mask. The anesthesiologist performing the technique recorded the intraoperative data and followed the patient postoperatively until discharged from post anesthesia care unit.

Assessment of sensory block by the loss of sensation to pinprick of 22 gauge blunt hypodermic needle and motor block by modified Bromage score[10] was done every 2 min for first 10 min, then every 5 min up to 30 min, every 15 min up to 120 min, half-hourly up to 240 min, and hourly until 12 h of surgery. Continuous multi-parameter monitoring of respiratory rate, heart rate, noninvasive systolic and diastolic blood pressure, SPO2, and electrocardiogram was done for hemodynamic response. Readings were recorded preoperatively, then intraoperatively at 0, 3, and 5 min, then at an interval of every 5 min up to 30 min, every 15 min up to 120 min, half-hourly up to 180 min, hourly until 12 h, and thereafter 3 hourly till 24 h of surgery in both the groups. Bradycardia (defined as heart rate <60 bpm) was treated with injection atropine sulfate intravenously according to heart rate. Hypotension (defined as systolic blood pressure <20% less than base value) was treated with intravenous ephedrine intravenously as per required and additional Ringer’s lactate solution. The operation was started when surgical anesthesia (up to the T10 sensory dermatome) has developed. In case of failed or partial neuraxial block, the patient was given general anesthesia and that patient was excluded from the study.

**Statistical analysis**

The data from the present study were systematically collected, compiled, and statistically analyzed. Data were expressed as means, standard deviation, number, and percentages. The patient characteristics (nonparametric data) were analyzed using the “Chi-square tests” and the intergroup comparison of the parametric data was made using the unpaired t-test. Power analysis was performed to calculate the power of the study which was well above 95%.

**Results**

The mean age, sex, weight, ASA grading, duration of surgery, baseline parameters, and quality of surgical analgesia were comparable in the two groups as shown in Table 1. Similarly, intraoperative and postoperative mean respiratory rate, systolic blood pressure, diastolic blood pressure, and saturation pressure of oxygen were also comparable.

The mean time to the onset of sensory block to T10 dermatome in Group L was 7.56 ± 1.52 min and in Group LD was 4.90 ± 0.88 min. The median maximum sensory level achieved in Group L was T6 dermatome in 15.23 ± 2.41 min and in LD group was at T4 dermatome in 7.43 ± 1.04 min.
The mean time taken for regression of sensory block to T10 dermatome in Group L was 96.10 ± 5.53 min and in Group LD was 126.36 ± 5.89 min. The mean duration of sensory block (time to regression to S1 dermatome) in Group L was 199.50 ± 7.96 min while in Group LD was 340.20 ± 11.78 min. All the differences were statistically highly significant between the two groups (P < 0.001) [Figure 1].

Mean maximum motor block achieved in patients of both the groups was modified Bromage score 2. Hence, the difference was found to be statistically nonsignificant (P > 0.05). However, the mean time taken to achieve maximum motor block was 12.10 ± 1.93 and 7.80 ± 1.32 min in Group L and LD, respectively. Furthermore, mean of the total duration of motor block in Group L and LD was 150.83 ± 9.17 min and 190.20 ± 9.61 min, respectively. Both the differences were highly significant (P < 0.001) [Figure 2].

The increase in VAS in Group L was observed at 120 min and patient demanded the first dose of rescue analgesia at the 3rd h postoperatively. Another increase in VAS score was again observed at the 8th h and second dose of rescue analgesia was given at 10th h. Third dose of rescue analgesia was given at 18th h and forth dose at 24th h.

In Group LD, increase in VAS was observed at 210 min and the first dose of rescue analgesia was given at 5th h postoperatively. The second dose of rescue analgesia was given at 12th h and the third dose was given at 21st h. Postoperative VAS scores at different time intervals were significantly lower in Group LD than Group L, thus indicating superior analgesia.

The time of request of the first dose of rescue analgesia was delayed in Group LD as it was demanded at 309.93 ± 23.19 min and in Group L was at 168.30 ± 12.32 min [Figure 3]. The difference in the two groups was highly significant (P < 0.001). A dose-dependent reduction in rescue analgesia requirements was noted in our study. A number of rescue analgesia doses were 3.60 ± 0.49 in Group L, whereas 2.90 ± 0.31 in Group LD and the difference was highly significant (P < 0.001) [Table 2].

Hypotension was observed in 10% of patients in Group L and LD, whereas bradycardia was observed in 3% of patients

![Figure 1: Mean duration of sensory block in both the groups](image1.png)
![Figure 2: Mean duration of motor block in both the groups](image2.png)

**Table 1: Demographic file and parameters**

| Parameters                      | Group L            | Group LD           | P      | Significance |
|---------------------------------|--------------------|--------------------|--------|--------------|
| Age (years)                     | 41.10±13.5         | 41.70±13.75        | 0.863  | NS           |
| Sex                             |                    |                    |        |              |
| Male                            | 18                 | 20                 | 0.42   | NS           |
| Female                          | 12                 | 10                 |        |              |
| Weight distribution             | 66.30±9.27         | 67.70±8.46         | 0.544  | NS           |
| ASA grading (%)                 |                    |                    |        |              |
| Grade I                         | 70                 | 60                 | 0.417  | NS           |
| Grade II                        | 30                 | 40                 |        |              |
| Duration of surgery             | 57.50±5.68         | 57.00±6.10         | 0.744  | NS           |
| Heart rate (bpm)                | 82.16±5.21         | 82.66±7.99         | 0.775  | NS           |
| Systolic blood pressure (mmHg)  | 128.00±4.10        | 124.56±12.02       | 0.144  | NS           |
| Diastolic blood pressure (mmHg) | 79.20±8.52         | 78.73±7.49         | 0.823  | NS           |
| Saturation of peripheral oxygen | 99.53±0.57         | 99.50±0.62         | 0.831  | NS           |
| Respiratory rate (bpm) (mean±SD)| 16.03±1.03         | 16.20±0.99         | 0.527  | NS           |

NS=Nonsignificant (P>0.05), SD=Standard deviation, ASA=American Society of Anesthesiologists
in Group L and 13% of patients in Group LD, which was statistically nonsignificant \((P > 0.05)\). None of the patients of Group L had urinary retention while it was observed in only 3% of patients of Group LD and the difference was statistically nonsignificant. Other side effects such as pruritus, nausea, vomiting, headache, backache, local anesthetic toxicity, and respiratory depression were not recorded in any of the patients of both the groups.

**DISCUSSION**

Regional anesthesia techniques are superior to systemic opioid agents with regard to analgesia profile and adverse effects.\(^5\) Levobupivacaine is a preferred local anesthetic due to its early onset and prolonged duration of sensory block, shorter duration of motor block, and lower cardiac toxicity. In previous studies, it was concluded that the addition of dexmedetomidine to levobupivacaine produces effective analgesia and prolonged the duration of motor and sensory block along with better postoperative analgesia and fewer side effects.\(^11\)-\(^13\) There was no statistical difference in change in the respiratory rate at different time intervals between the two groups \((P > 0.05)\). This lack of respiratory depression with dexmedetomidine has also been demonstrated in studies done by Esmaoğlu \textit{et al}.\(^14\) and Basuni and Ezz.\(^15\) Similarly, the mean heart rate at various intervals intraoperatively was found to be comparable in both the groups. The mean dose of atropine given in Group LD was 1.7 mg and in Group L was 1 mg. It was in accordance with a study conducted by Esmaoğlu \textit{et al}.\(^14\) Basuni and Ezz observed bradycardia in 3.3% of patients in levobupivacaine and dexmedetomidine group, whereas it was in 13% of patients in our study. This can be explained by the fact that dose of levobupivacaine used in the study by Basuni and Ezz was 4 mg, whereas the dose was 15 mg in the present study. However, there was no statistically significant difference in the mean heart rate of both the groups during the perioperative and postoperative period \((P > 0.05)\) in both the studies.

The addition of dexmedetomidine to levobupivacaine intrathecally does not cause significant hypotension as was observed in studies done by Esmaoğlu \textit{et al}.\(^14\) and Raval and Chaudhary.\(^16\) The time to onset of sensory block was decreased with the addition of dexmedetomidine to levobupivacaine in the present study and the same was observed by Dizman \textit{et al}.\(^17\) and Sathitkarnmanee \textit{T et al}.\(^18\) The addition also resulted

**Figure 3:** Total duration of analgesia in both the groups
in prolonged duration of the sensory block as compared to levobupivacaine alone. This finding was near consistent with studies done by Esmaoğlu et al., Basuni and Ezz, Kanazi et al.,[14]and Deori et al.[20]

No difference in the level of motor block was noticed with the addition of dexmedetomidine to levobupivacaine. However, the addition of dexmedetomidine to levobupivacaine demonstrated a prolongation of the motor block as reported by Esmaoğlu et al.[14]

The addition of dexmedetomidine to levobupivacaine improved the postoperative analgesia resulting in a reduction of the number of analgesic doses required in the 24 h postoperatively. Better degree of analgesia in Group LD seen in our study was due to the synergism of dexmedetomidine and levobupivacaine and effectiveness of dexmedetomidine in abolishing visceral pain. This was in accordance with studies conducted by Kim et al., Basuni and Ezz, Eid et al., and Amer et al.[22]

Hypotension was seen in 10% of patients each in Group L and Group LD and bradycardia was 3% in Group L and 13% in Group LD, and the differences were statistically nonsignificant ($P > 0.05$) between the two groups ($P > 0.05$) as observed by Esmaoğlu et al.[14] and Amer et al.[14]

**Conclusion**

It is concluded from our study that both the groups were effective in providing surgical anesthesia and hemodynamic stability, but Group LD was better than Group L as regards:

- Early onset of sensory and motor block
- Prolonged duration of sensory and motor block
- Longer duration of postoperative analgesia
- Lesser number of doses of rescue analgesia required.

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**Conflicts of interest**

There are no conflicts of interest.

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