

Original Research Article

Use of a local anesthetic and opioid combination in spinal anesthesia in short urologic surgeries

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Received: 31 October 2018

Revised: 03 December 2018

Accepted: 28 December 2018

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ABSTRACT

Background: To investigate how low-dose levobupivacaine affects both surgical comfort and hemodynamics in patients undergoing short urologic procedures using spinal anesthesia.

Methods: Our study was conducted prospectively and double-blind. The study group comprised 40 patients aged 18-65 years from the ASA I-III risk group who had undergone short urological interventions, randomly split into two groups. Informed consent and ethics committee approval were received. Using a media approach and placed in the lateral decubitus position, the patients were given spinal anesthesia using 22 G catheter. Group L was given 1.5ml of levobupivacaine (7.5mg) at 0.5% concentration +0.5ml of saline. Group LF was given 1.2ml levobupivacaine (6mg) at 0.5% concentration +25µg fentanyl (0.5ml) +0.3ml saline. Patient data including peripheral oxygen saturation; systolic, diastolic, mean arterial pressure; time to first postoperative need for analgesics, and spinal block characteristics were recorded at 3, 5, 10, 15, 30, 60, 120 and 360minutes after spinal anesthesia.

Results: No significant differences were observed in the demographic and hemodynamic data between groups. Motor blocks were seen to wear off more in Group LF than in Group L at 120minutes. Group LF required first postoperative analgesics later than Group L; this difference was not significant.

Conclusions: Sufficient anesthesia was achieved in both groups via spinal block using local anesthetic or local anesthetic plus opioid for relatively short urological procedures. The latter group recovered faster.

Keywords: Local anesthetics, Short urologic surgery, Spinal anesthesia

INTRODUCTION

Urologic interventions constitute 10-20% of the operations requiring anesthesia. Urinary system interventions can be performed via the endoscopic methods (cystoscopy, transurethral interventions to the prostate or bladder; or via the endoscopic interventions to manage stones in the ureter, etc.); or they can be conducted in the form of open surgical interventions. Today, open surgeries have mostly been replaced by endoscopic interventions. The majority of the patient

group undergoing these interventions consist of either adult patients in older ages or of children. The clinical picture may be accompanied by comorbid diseases (respiratory or circulatory diseases, renal function disorders, hypertension, or congenital anomalies, etc.). The decision on the method of anesthesia to be performed is made within the frame of general principles. Several regional anesthesia methods can be applied favorably. These methods include topical anesthesia of the urethra, infiltration anesthesia, nerve blocks; and spinal, epidural, and caudal blocks.^{1,2}

The importance of surgical interventions minimizing the length of stay and the associated costs, enhancing the patient comfort, and requiring the hospital stay at a maximum of only 1 day, have been recently on the rise. Regional and general anesthesia methods or central (spinal and epidural) and peripheral nerve blocks can be applied during these types of interventions. The anesthesia methods other than general anesthesia, which provide faster recovery periods, have gained importance. Spinal anesthesia is also frequently used for this purpose. The emergent motor blockades and dose-associated side effects are the major obstacles to early recovery after spinal anesthesia. However, the anesthesia quality is diminished when the dose is reduced to avoid these effects. On the other hand, the addition of opioids to low-dose local anesthetics reduces side effects of the latter and abolishes the motor blockades earlier while providing a sufficient duration of time under anesthesia.³ It is desirable that the motor blockades begin to abolish faster, the length of stay in the hospital is minimized, and the achieved level of the sensory block is sufficient.⁴

Levobupivacaine is bupivacaine's s(-) enantiomer and an amide-group local anesthetic. Levobupivacaine causes less motor blockade compared to bupivacaine, has a slower onset of anesthesia, has a faster dermatome regression time, and has similar hemodynamic properties to bupivacaine.⁵ Levobupivacaine may be preferred especially during short surgical interventions not requiring motor blockade.⁶

As the dose of levobupivacaine to achieve local anesthesia increases, the side effects, and motor blockade increase as well. In this study, we evaluated the effects of levobupivacaine and the combination of opioid medication and levobupivacaine on the hemodynamics of the patients, on the level of sedation, on the duration of time of the sensory and motor blockades as well as the surgical satisfaction and requirement for additional anesthesia in patients aged from 18 to 65 years old, having ASA scores of I-III, and undergoing short urological interventions.

METHODS

Our study was conducted as a prospective, randomized (the patients were selected by drawing lots), and controlled study. A total of 40 patients aged from 18 to 65 years old and having ASA scores of I-II-III, and who were scheduled to undergo spinal anesthesia for short elective urological surgical interventions, were included in the study and assigned to two separate groups.

The patients were evaluated a day before the surgery, their laboratory tests were performed, and their ages, heights, and body weights were recorded. The patients were informed of the procedure and their consents were collected. The patients who refuse to comply with the interventions were excluded from the study. Patients who

signed the consent form received a closed envelope containing the group information.

Each patient was premedicated with 0.03mg/kg of i.m. midazolam 30 minutes before the operation. The patients were randomized into two groups consisting of 20 individuals according to the closed envelopes they received during the anesthetic evaluation. All patients were routinely monitored with 3-lead electrocardiogram, pulse oximetry, noninvasive blood pressure recording. After performing the required preparations to start general anesthesia anytime, IV lines were established with 18G catheters. 500ml of physiologic saline solution was administered before spinal anesthesia. A 26G needle was introduced into the subarachnoid space using the median approach in lateral decubitus position under sterile conditions. Patients in the first group received levobupivacaine (Group L; 7.5mg of levobupivacaine in 1.5ml at a concentration of 0.5% +0.5ml physiological saline solution). Patients in the second group received levobupivacaine and fentanyl (Group LF; 6mg of levobupivacaine in 1.2ml at a concentration of 0.5% + 0.5ml fentanyl (25µg) +0.3ml physiologic saline solution).

After applying the spinal anesthesia, the following patient data were recorded in the 3rd, 5th, 10th, 15th, 30th, 60th, 120th, and 360th minutes: systolic, diastolic, and mean arterial blood pressure; heart rate, peripheral oxygen saturation level, time to first request for postoperative analgesic, and bilateral levels of sensory and motor block. In case of hypotension (>30% reduction in the baseline systolic arterial pressure) during the operation, 200ml physiologic saline was rapidly infused in 10minutes via i.v. line. If ineffective, 5mg of ephedrine was administered. In case of bradycardia (heart rate <45beats/min), 0.5mg atropine was given intravenously. The level of the sensory block was assessed by the Pin Prick Test and the level of the motor blockade was assessed using the "Bromage Scale" (Bromage 0-1: no paralysis; Bromage 2-3: paralysis is evident). The pain was evaluated using the Numeric Rating Scale (NRS; 0-10). Analgesic medications were administered when NRS scores were >4. The satisfaction from surgery was evaluated on a 4-point scale with a score of 1 as poor while scores of 2, 3, and 4 were evaluated as moderate, good, and excellent, respectively.

Statistical analysis was done with SPSS for windows version 17 (USA). The conformity of the data to a normal distribution was assessed with Kolmogorov-Smirnov test. Data conforming to a normal distribution were expressed as means±standard deviations and analyzed with Student's t-test. Data not conforming to a normal distribution were expressed as median (interquartile range, range) and analyzed with Mann-Witney U test. Variance analysis (post hoc paired t-test) was used in repeated measures to compare the time-associated changes in hemodynamic parameters within each group. Categorical data were expressed as numbers and

percentages and analyzed with Chi-square test. The significance level was accepted to be $p < 0.05$.

RESULTS

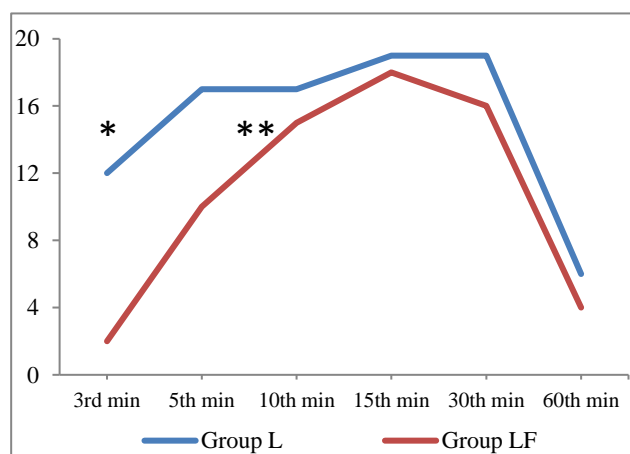
A total of 40 patients were included in the study. In summary, patient characteristics such as distribution of

gender, age, anthropometric measurements like height and weight, and duration of surgery were equally distributed between the groups in our study ($p > 0.05$, Table 1). There were no statistically significant differences in the systolic, diastolic, and mean arterial pressure levels or in the pulse rates between the groups ($p > 0.05$).

Table 1: Patient characteristics and antropometric measurements.

Characteristics	Subgroups	Group L (n = 20)	Group LF (n = 20)	p value
Male gender (n, %)		17 (85%)	12 (60%)	0.157
Age (years)		61.8±17	58.4±18	0.280
Height (cm)		173.9±6.18	170.3±8.7	0.149
Body weight (kg)		80±13.8	74.4±13.3	0.199
ASA risk group, (n)	I	12 (60%)	11 (55%)	0.787
	II	8 (40%)	9 (45%)	0.787
Duration of the surgery (min)		44.8±30.9	36 ±15.8	0.267

ASA, American Society of Anesthesiology. Data are presented as number (%proportion), or mean±standard deviation



*Statistical significance ($p = 0.003$), **Statistical significance ($p = 0.043$)

Figure 1: The number of patients with sensorial blockade at the level of t-10 dermatome at specified time points between 3rd and 60th minutes.

The number of patients with sensory blockade at the level of T-10 dermatome was significantly higher in Group L compared to Group LF at the 3rd and the 5th minutes ($p < 0.05$, Figure 1).

Levels of motor blockade at 120th, 240th, and 360th minutes are given in Table 2. In summary, motor blockade wore off in more patients in Group LF (14, 70%) compared to Group L (6, 30%) at the 120th minute ($p < 0.05$, Table 2). While 60 and 360 minutes, there was no difference in motor block between the two groups.

There were no statistical differences between groups in terms of requirement for analgesic (Group L: 5 patients [25%], Group LF: 9 patients [45%], $p > 0.05$). However, the duration of postoperative analgesia was longer in the Group LF compared to the Group L (Group L: 179 ± 107.84 , Group LF: 211.11 ± 46.82 , $p = 0.682$). The satisfaction from the surgery was not statistically significantly different between the groups ($p > 0.05$).

Table 2: Comparison of the motor blockade levels between the groups.

Characteristics	Group L (n = 20)		Group LF (n = 20)		p value
Bromage score	2-3	0-1	2-3	0-1	
60th min	19 (95%)	1 (5%)	15(75%)	5 (25%)	0.182
120th min	14 (70%)	6 (30%)	6 (30%)	14 (70%)	0.026*
360th min	-	20 (100%)	-	20 (100%)	1

Data are presented as number (%proportion). $P < 0.05$ *

DISCUSSION

In today's practice, hospitals and patients are more inclined to ambulatory surgeries to reduce the time and

costs, minimize the workforce. Methods to minimize the length of hospital stay are preferred as well if hospital stays longer than 1 day are required. Therefore, neuroaxial blocks are increasingly employed for these

purposes. Low doses of local anesthetics and opioid combination used for spinal anesthesia in the LF Group in our study appears to be a suitable method to achieve faster recovery times and shorter duration of time until ambulation, which are the required features for the purposes referred above.

Similar to our study patient groups, the majority of patients undergoing short urologic surgical interventions belong to older age groups, frequently presenting with co-morbid cardiac, pulmonary, and other systemic diseases.⁷ A high level spinal block as well as high doses of local anesthetics may have serious adverse hemodynamic effects in this age group.⁸ The underlying factors include the degeneration in the central and peripheral nervous system associated with aging, changes in the lumbar and thoracic segments in the spinal cord as well as the reductions in the amount of the cerebrospinal fluid.⁹

In order to avoid those side effects, the most commonly applied method is to reduce the dose of the local anesthetic. However, insufficient anesthesia and analgesia, and decreased comfort are the main problems encountered with this method. Adjunct drugs were introduced to solve this problem.

Adjunctive use of opioids with low-dose local anesthetics in neuroaxial anesthesia is the most commonly used method to achieve sufficient sensory and motor blockade without emergent hemodynamic side effects. This technique was successfully used even in major orthopedic surgical interventions, which require prolonged motor blockade as well as sensory blockade. Ertürk et al, performed spinal anesthesia in patients with a mean age of 69-70, scheduled for hip replacement surgery by administering 8mg bupivacaine + 20µg fentanyl to one group and 12mg ropivacaine + 20µg fentanyl to the other group; and achieved sufficient levels of anesthesia in both groups.⁸ They reported that no serious side effects were encountered due to the administration of reduced doses of local anesthetics.

Local anesthetics at very low doses are successfully administered with the adjunctive use of opioids, especially in some surgical procedures, not requiring higher levels of motor blockade. Assigning the older age patients who would undergo Transurethral Resection of the Prostate (TURP) into two groups, Kim et al administered 25µg fentanyl in one group and 5µg sufentanil in the other group adjunctive to 4mg bupivacaine in both groups and they achieved sufficient anesthesia in both groups of patients.⁷ They reported that they did not encounter any hemodynamic side effects due to the use of lower doses of local anesthetic medications although the authors studied an older age patient group.

Likewise, in daily obstetric surgical interventions and in laparoscopic tubal ligation operations where motor blockade has not been a major requirement, Santiago et

al. performed spinal anesthesia by administering a much lower dose of levobupivacaine (3mg) with adjunctive 10µg of fentanyl and reported that they usually achieved sufficient levels of anesthesia.¹⁰ They suggested that the administration of local anesthesia at lower doses presented with a lower potential for side effects allowed faster recovery periods and produced significant reductions in costs because of the earlier hospital discharge times. We did not encounter any serious side effects with the use of a low-dose local anesthetic + fentanyl combination in our patients, in whom a motor blockade was not a requirement. Moreover, we observed faster recovery times in these patients.

On the other hand, the type of the local anesthetic used in the intervention impacts the features of the blockade as well as the dose. In addition to the studies reporting that levobupivacaine, the S (-) enantiomer of bupivacaine, is as equivalent as bupivacaine.^{5,11} There are also studies demonstrating an inferior level of motor blockade and analgesia with levobupivacaine compared to bupivacaine.¹²⁻¹⁴

Another major issue is the hemodynamic effects of the local anesthetics on the cardiovascular system. Some studies have shown that cardiotoxic effects of levobupivacaine are observed to a lesser extent compared to bupivacaine.⁵ However, the vasoactive properties of local anesthetics also affect the features of the blockade. It has been shown that the vasoconstrictive properties of levobupivacaine emerge to a larger extent compared to bupivacaine.^{15,16}

Achieving anesthesia and sufficient sensory blockade in cesarean cases; Bidikar et al demonstrated that the adjunctive use of 12.5µg fentanyl with 7.5mg levobupivacaine produced motor blockade to a lesser extent compared to the blockade obtained with the administration of 10mg levobupivacaine.¹⁴ In the light of the referred information in the literature, we preferred levobupivacaine as a local anesthetic and we did not encounter with any serious hemodynamic side effects during our study.

Several factors have been reported for the intrathecal blocks, affecting the quality of the block as well as affecting the side effect potential of the procedure. These factors include the baricity, volume, dose, concentration, temperature, and the viscosity of the local anesthesia employed in the procedure.¹⁷ Spinal anesthesia procedures performed with hyperbaric solutions and especially with higher volumes result in more intensive blockades, however, more side effects can be observed in those cases. In our study, we preferred to use the isobaric form of levobupivacaine with a reduced dose and a lower volume in combination with an opioid medication, achieving appropriate blockades consistent with our purpose.

There are numerous studies in the literature about the adjunctive use of opioids with the intrathecally administered local anesthetic medications.^{8,14,18} Spinal blockades were performed with adjunctive use of fentanyl at a wide range of doses to produce a synergistic effect and to obtain blockades at a higher extent with the use of lower doses, and then, the clear-cut findings were presented. The use of intrathecal opioids may cause nausea, vomiting, pruritus, sedation, and respiratory depression. Especially increases the rate of sedation and respiratory depression was reported with the use of fentanyl at doses higher than 50µg of fentanyl.¹⁹ In their study, Gaiser et al reported that there were no requirements for the use of fentanyl at doses higher than 25µg.²⁰ Therefore, the 25µg adjunctive dose of fentanyl appears to be appropriate for this purpose.

Combining opioids with neuroaxial blocks also increases the duration of the analgesia in the postoperative period, reducing the amount of analgesics to be used postoperatively. Thus, the duration of the time until the first requirement for analgesic medication in the postoperative period was found to be longer in the Group LF, where adjunctive fentanyl was used, compared to the Group L.

However, this difference did not reach statistical significance. We are in opinion that the reason was the large standard deviation. We are of the opinion that selection of the patients who will undergo the same type of surgery may overcome this issue so that the positive effects of the adjunctive use of opioids on the duration of postoperative analgesia will be demonstrated more clearly. Patients in Group L showed higher levels of sensory and motor blockades, especially in the late postoperative period. This led to a delayed mobilization in this group.

CONCLUSION

In conclusion, with the intrathecal administration of a low dose of levobupivacaine a sufficient level of spinal anesthesia were achieved in both groups without any serious emergent complications. Furthermore, the adjunctive use of fentanyl allowed the motor block to wear off quicker. Fewer requirements for postoperative analgesics and an earlier mobilization in the postoperative period are the main advantages of this technique.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Karadeniz Technical University, Farabi Hospital's Ethics Committee (Date: 8 May 2009, no: 2009/47)

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Cite this article as: Özdemir A, Çolak MS. Use of a local anesthetic and opioid combination in spinal anesthesia in short urologic surgeries. *Int J Res Med Sci* 2019;7:351-6.