COMPARISON OF THE EFFECTS OF INTRATHECAL DIFFERENT DOSAGE OF LEVOBUPIVACAINE IN ELECTIVE DAY-CASE ARTHROSCOPY OF THE KNEE

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Abstract

Background and objectives: To observe the motor and sensorial block characteristics with different dosage of levobupivacaine during spinal block for the patients undergoing day-case knee arthroscopy.

Material and method: Eighty, 80 ASA physical status I–II patients, undergoing day-case knee arthroscopy received 0.5% levobupivacaine; 7.5 mg in Group I, 10 mg in Group II, 12.5 mg in Group III and 15mg in Group IV for spinal anesthesia. Maximum sensorial and motor block levels, sensorial and motor block durations, time to required readiness to surgery after block and side effects were recorded.

Results: The time required to achieve readiness to surgery was longest and mean duration of sensory and motor block was shortest in Group I. The groups were similar in regards to the number of failed blocks requiring general anaesthesia ($p > 0.05$). First micturition and unassisted ambulation with crutches times were shortest in Group I ($p < 0.01$). Home discharge and first additional analgesic request time were similar in four group ($p > 0.05$).

Conclusion: The motor and sensorial block obtained with different spinal anesthesia dosages of 0.5% levobupivacaine were effective for day-case knee artroscopy. Although 7.5 mg is suitable for patients; 10, 12.5 and 15 mg could be used according to anesthetist experience without any side effects.

Key Words: Spinal anaesthesia, day-case, knee arthroscopy, dose investigation.

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Introduction

Levobupivacaine is the S-enantiomer of bupivacaine with a similar effect profile, but a documented reduced central nervous system and cardiovascular toxicity, as compared to bupivacaine[1-3].

Day-case surgery is increasing worldwide and newer and better drugs with short onset and duration of effect is resulting in quick recovery and the possibility of earlier discharge from the day surgical unit[4-5]. Day-case surgery has economical cost effectiveness and provides early mobilization, patient comfort, and decrease in nosocomial infection incidence. In day-case surgery regional anesthesia is choosen because there are little changes in the central nervous system, the degree of postoperative pain is smaller and the postoperative complications (nausea, vomiting, drowsiness, etc.) are less seen. In day-case surgery the drugs used have minimal side effects, provide rapid recovery and have high reliability[6-8].

We conducted a prospective, randomized study to compare the different dosages effects of 0.5% levobupivacaine on sensorial and motor block characteristics, perioperative complications, postoperative analgesia, and hospital discharge time in day-case knee arthroscopy under spinal anesthesia.

Materials and Methods

The study protocol with a prospective, randomized design was approved by the hospital's ethics committee and written informed consent was obtained from all patients. Eighty, ASA physical status I-II patients, aged 18-67 year, scheduled for elective day-case knee arthroscopy were included in the study.

Patients in whom neuraxial block was contraindicated, who had neuromuscular disease, and who were hypersensitive to amide local anesthetics were excluded from the study.

All patients received 0.05mg/kg im midazolam 45 minutes before the surgery and intravenous 500 ml Lactated Ringer's infusion over 20 min. Continuous monitoring included 3 waves EKG, measurement of noninvasive blood pressure and pulse oximetry.

Patients were randomized (sealed envelope technique) to four groups. Group I (n = 20): 7.5mg of 0.5% levobupivacaine (Chirocaine; Abbott, Sweden), Group II (n = 20): 10mg of 5% levobupivacaine; Group III (n = 20): 12mg of 5% levobupivacaine, and Group IV (n = 20): 15 mg of 5% levobupivacaine. Fentanyl 0.01 mg iv was applied as rescue drug for analgesia and sedation during the surgery.

Spinal anesthesia was performed at the L_{3-4} or L_{4-5} intervertebral space using a 25 gauge Whitacre spinal needle while the patient was in the sitting position. Following visualization of cerebrospinal fluid in the hub of the needle different dosages of levobupivacaine was administered over 15 seconds without barbotage. The patient was immediately placed in the supine position.

An assistant anesthesiologist blinded to the injected solution recorded the level of the sensorial and motor blocks every 3 minute until readiness for surgery and then every 5 minute until the maximum level was reached. Further assessment was performed every 30 minutes until complete regression of spinal block. The bilateral level of sensory block was recorded at identical time points along the midclavicular line by assessing changes in pinprick sensation. Motor block was assessed using a modified Bromage scale (0 = no motor block; 1 = unable to raise extended leg, can bend knee; 2 = unable to bend knee, can flex ankle; 3 = no movement).

Readiness to surgery was defined as the Bromage's score ≥2 and loss of pinprick sensation at T_{12} on the operated side.

The maximum sensory block level and maximum Bromage score were recorded. Regression time from maximum block level to S_5 was assessed as the duration of the sensory block. Duration of motor block was assessed by recording the time elapsed from maximum Bromage score to motor block has disappeared. Duration of analgesia was recorded as the time elapsed between intrathecal injection and the first analgesic request postoperatively.

The quality of spinal block was judged according to the need for supplementary iv analgesics and sedation preoperatively (adequate spinal block = neither sedation nor analgesics were required to complete surgery; inadequate spinal block = need for additional analgesia required to complete surgery; failed spinal block= general anesthesia required to

complete surgery).

At the same observation times, systolic and diastolic blood pressures (SBP, DBP), heart rate (HR) were also recorded. Hypotension was defined as a decrease of 30% or more from baseline systolic pressures and it was initially treated with a rapid intravenous infusion of 200 ml lactated Ringer's solution; if this proved to be ineffective, efedrine 5 mg iv was injected. Clinically relevant bradycardia was defined as heart rate decrease to less than 55 bpm, and it was treated with atropine 0.5 mg iv.

The incidence of side effects such as nausea, vomiting, hypotension, bradycardia, bladder catheterization, back pain, paresthesia in glutei and legs were noted in recovery room and postoperative at 24 hour.

First micturition, unassisted ambulation with crutches and home discharge time were recorded. Standard criteria for home discharge were used.

Statistical analysis was performed using the program SPSS 11.5 for windows. Demographic data were analyzed with the one way ANOVA; onset time of surgical block and recovery times were analyzed with the Kruskal-Wallis test. First micturition, unassisted ambulation with crutches, home discharge and first additional analgesic request time were also analyzed with Kruskal-Wallis test.

Results

The majority of our patients had meniscus resection and/or shaving of synovia, but no major procedures. No differences in demographic data and duration of surgery were reported among the four groups (Table1). The groups were similar in regards to the number of failed blocks requiring general anesthesia (p>0.05). Although four patients in Group I and one patient in other groups were excluded from the study because of failed spinal block; the quality of the spinal block were similar among the groups (p >0.05).

The characteristics of spinal block are outlined in Table 2. The time required to readiness to surgery was longer in Group I than the other groups (p <0.01). No differences were observed among the other groups (p >0.05). The median maximum sensory level on the operated side was $T_{10\text{-}11}(T_{12}\text{-}T_6)$ in Group I and this block level was lower than the other groups (T_8 (T_{12}-T_2) in Group II; $T_{10}(T_{12}\text{-}T_4)$ in Group III; $T_8(T_{12}\text{-}T_3)$ in Group IV (p<0.05). The time to reach maximum sensory block was less in the Group IV than the others (p<0.05).

Table 1

Demographic variables are mean±standard deviation and duration of surgery values are median (min-max)

	M/F (%)	Age(years)	BMI (kg/m^2)	Duration of surgery (min)
Group I	12/4	34.8± 11.3	25.7±2.9	27(13-45)
Group II	8/11	42,9 ±12,7	28,8±4,6	24(13-69)
Group III	13/6	44,9± 10,2	28,3±3,6	24(15-40)
Group IV	9/10	42± 11,2	27,9±4,4	25(14-44)
	p >0.05	p >0.05	p >0.05	p >0.05

Mean duration of sensory block was shortest in Group I than other groups (p <0.001). In Group II sensory block recovered before Group IV (p <0.05).

Table2

The characteristics of spinal block. Data are presented as mean±SD except for Max Sensory Block Level, Max Motor Block score, Max Motor Block Time, and Duration of Sensory Block: median(minimum-maximum)

	Readiness to Surgery in minutes	Max Sensory Block level	Max Motor Block score	Max Sensory Block Time in minutes	Max Motor Block Time in minutes	Duration of Sensory Block in minutes	Duration of Motor Block in minutes
Group I	16±6*	T10-11** (T12-T6)	3 (2-3)	22±6	18 (6-26)	182(135-267)♦	171±41♦♦
Group II	10±5	T8(T12-T2)	3 (2-3)	21±9	12 (6-33)	210(176-400)	198±48
Group III	10±5	T10(T12-T4)	3 (2-3)	21±8	12 (6-34)	248(135-366)	231±64
Group IV	9±4	T8(T12-T3)	3 (2-3)	15±6#	11 (6-26)	262(176-382)	259±83
	p <0.01	p <0.05	p >0.05	p <0.05	p >0.05	p <0.001	p <0.001

* p <0.01 Group I with other groups

** p <0.05 Group I vs. group II and group IV

# p <0.05 Group IV vs. other groups

♦ p <0.001 Group I vs. other groups

♦♦ p <0.001 GroupI vs. other groups)

The maximum bromage scores and time to reach maximum bromage scores were similar in all groups (p >0.05). Mean duration of motor block was shorter in Group I than Group III and GroupIV (p <0.01). There was no difference between the Group I and Group II (p >0.05).

Mean SBP, DBP and HR were similar within each group and in all groups at all times(p >0.05). Hypotension and/or bradycardia requiring treatment did not occur in any of the four groups.

First micturition and unassisted ambulation with crutches times were shortest in Group I than the others groups (p <0.01). Home discharge and first additional analgesic request time were similar in four groups (p >0.05) (Table 3).

In Group II, one patient required bladder catheterization postoperatively and one patient reported postdural headache requiring readmission to the hospital. Side effects were similar in all groups (p>0.05).

Discussion

Lidocaine was considered an ideal choice for outpatient knee arthroscopy until transient neurologic symptoms were consistently reported after lidocaine spinal block[9]. It has also been reported that outpatient status and knee arthroscopy position represent other relevant and independent risk factors for developing transient neurological symptoms after spinal anesthesia[10]. For this reason, small doses of long-acting local anesthetics have been proposed to produce short-lasting spinal anesthesia. Levobupivacaine, a bupivacaine enantiomer, is preferred because it has a reduced cardiac toxicity on overdose and little CNS side effects[11-12]. Levobupivacaine is increasingly used for spinal anesthesia with different doses for elective day-case arthroscopy of the knee[13-15].

There are different types of arthroscopic surgery such as diagnostic meniscus resection, shaving of snovia, and some major procedures such as ACL rupture. The majority of our procedures were meniscus resection and shaving of snovia; These procedures have similar pain scores. We didn't choose major procedures such as ACL rupture because they have different pain scores from our procedures[16-17].

We used 7.5, 10, 12.5 and 15mg of levobupivacaine to observe the least effective dose of levobupivacaine while providing effective anesthesia and rapid mobilization and less complication. We performed an adequate sensorial and motor blocks in all study groups. Gautier et al [18] performed spinal anesthesia with 8 mg levobupivacaine and sufentanil 2.5 µg for caesarean section and they reported 20% inadequate motor block. Burke et al[19] reported 5% inadequate motor block in 20 patients with 15 mg levobupivacaine for spinal anesthesia; 2 patients required supplemental anesthesia and 10 patients requested 0.5-1.5 µg/kg/min propofol for intraoperative sedation. Vercauteren et al[20] and Convery et al[21] observed weaker motor block with levobupivacaine than bupivacaine in laboring patients. Bremerich et al[22] evaluated the hyperbaric 7.5, 10 and 12.5 mg levobupivacaine for spinal anesthesia during caesarian section and they did not provide satisfactory intraoperative analgesia with 7.5 levobupivacaine. Because analgesic and motor block characteristics were similar between 10 and 12.5 mg levobupivacaine,

Table3

The first micturition, ambulation and analgesic intake times and hospital discharge times in all groups: median (min-max)

	Micturition Time in minutes	Ambulation Time in minutes	Time to First Analgesic in minutes	Discharge Time in minutes
Group I	211 (108-487)*	265 (139-468)**	663 (282-1461)	1376 (312-2658)
Group II	311 (186-565)	330 (199-565)	612 (90-1517)	1446 (473-1582)
Group III	279 (148-673)	304 (195-1288)	614 (218-1669)	1333 (304-1555)
Group IV	325 (222-490)	414 (313-492)	605 (105-1610)	1365 (343-1549)
	P <0.01	p <0.01	p >0.05	p >0.05

* p <0.01 Group I vs. other groups

** p <0.01Group I vs. other groups

they recommended 10 mg levobupivacaine for elective caesarian section with spinal anesthesia. We observed an adequate motor block in all our patients and none of the patients need intraoperative sedation or supplemental analgesia.

In our study, the duration to obtain an adequate blockage for the operation was longer but the sensorial and motor block duration was shorter with 7.5 mg levobupivacaine. The first micturition time and the duration for unassisted ambulation with crutches were also shorter. We did not observe differences for the discharge times due to the preference of the surgical clinics to observe the patients at least one day postoperatively.

In conclusion; levobupivacaine 7.5, 10, 12.5 and 15 mg provide satisfactory intraoperative anesthesia for elective day-case knee arthroscopy.

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