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Bilateral vs. unilateral spinal anesthesia for outpatient knee arthroscopies

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Abstract This prospective randomized study compared unilateral and bilateral spinal anesthesia with respect to intraoperative and postoperative complications, and time to discharge from hospital for knee arthroscopies in outpatients. We studied 70 ASA I patients scheduled for elective outpatient knee arthroscopy. The patients were randomly allocated into two groups to receive either 3 ml (15 mg) 0.5% hyperbaric bupivacaine (bilateral group) or 1.5 ml (7.5 mg) 0.5% hyperbaric bupivacaine (unilateral group). The duration of motor and sensory block and the time to discharge from the hospital were all recorded. Perioperative complications such as hypotension, bradycardia, nausea, vomiting, urinary retention, if present, were recorded. The patients were interviewed by telephone 7 days later, and each patient was asked about headache or backache. The duration

of motor and sensory block, and the time to discharge from hospital was shorter in the unilateral group than in the bilateral group. Three patients in the bilateral group were treated for hypotension. Bradycardia occurred in two patients in the bilateral group, and three patients required temporary bladder catheterization due to delay in recovery of spontaneous urination. Nausea and vomiting occurred in three patients in bilateral group. Nine patients in the bilateral group and six patients in the unilateral group developed postspinal headache. Backache occurred in five patients in the bilateral group and in six patients in the unilateral group. Our data indicate that the use of unilateral spinal block is a suitable technique for knee arthroscopies in outpatients.

Keywords Unilateral spinal anesthesia · Outpatient arthroscopy · Bupivacaine

Introduction

Outpatient surgery has become more popular because of its lower costs and greater patient turnover. Outpatient surgery requires anesthesia methods that allow rapid recovery and safe discharge of the patient. Regional anesthesia has been advocated for outpatient surgery because of alertness, pain relief, cost-effectiveness, and rapid discharge [5,16]. Spinal anesthesia is usually simple and quick to perform. In outpatient surgery spinal anesthesia is still controversial because of its many complications, such as hypotension, nausea and vomiting. Hypotension is

the most common side effect of spinal anesthesia. Treatment by volume loading or vasoactive drugs may postpone discharge from hospital [3]. The use of spinal anesthesia may lead to the development of transient neurological symptoms especially when short-acting anesthetics (e.g., lidocaine) are used [9]. Bupivacaine is long-acting, which restricts its use in ambulatory surgery. However, small doses of bupivacaine have been suggested when performing spinal anesthesia in outpatients [1].

The purpose of this prospective randomized study was to compare unilateral and bilateral spinal anesthesia, their intraoperative and postoperative complications, and time to discharge from the hospital for knee arthroscopies.

Table 1 Demographic data

	Bilateral group (n=35)	Unilateral group (n=35)	P
Age (years)	36.28±10.20	36.68±9.62	>0.05
Height (cm)	170.28± 9.40	169.05±7.71	>0.05
Weight (kg)	74.74±11.70	72.71±9.30	>0.05
Duration of surgery (min)	53.40±10.07	54.20±9.67	>0.05
Male/female	23/12	24/11	>0.05

Materials and methods

With the approval of the Ethics Committee, we studied 70 American Society of Anesthesiologists class I patients scheduled for elective outpatient knee arthroscopy. All the patients were informed about the type of anesthesia to be used, and their consent was obtained. The cases with contraindications for spinal anesthesia were excluded. Patients were randomly placed in two groups to receive either 3 ml (15 mg) 0.5% hyperbaric bupivacaine (bilateral group) or 1.5 ml (7.5 mg) 0.5% hyperbaric bupivacaine (unilateral group) using coin toss. Standard monitoring was used throughout the study, including noninvasive arterial blood pressure, heart rate, and pulse oximetry. Demographic data regarding age, gender, weight, height, and duration of surgery did not differ between the two groups (Table 1).

The patients were placed in lateral decubitus position with the limb to be operated on in the dependent position. Dural puncture was performed at the L3–L4 interspace, using a 25 gauge Qincke spinal needle with a midline approach. After observing the flow of cerebrospinal fluid through the needle, in the unilateral spinal anesthesia group, the needle orifice was turned toward the dependent side and 7.5 mg 0.5% hyperbaric bupivacaine was injected without further CSF aspiration, and the lateral decubitus position was maintained for 10 min. In the bilateral spinal anesthesia group 15 mg of the 0.5% hyperbaric bupivacaine solution was injected with the needle bevel cranially directed, and the patients were immediately turned to the supine position. Following this the pin-prick test was used to assess the level and onset time of sensory block. The degree and onset time of lower limb motor block was evaluated using the modified scale Bromage et al. [2] (0=no paralysis, able to flex knee and ankle; 1=unable to raise extended leg but able to flex knee; 2=unable to flex knee but able to flex ankle; 3=unable to move lower limb).

Hemodynamic variables were recorded preoperatively and at 5-min intervals during the operation. A 25% decrease in systolic blood pressure compared to the preoperative value was regarded as hypotension. The occurrence of clinically relevant hypotension as generally accepted below the systolic blood pressure 90 mmHg was treated with an intravenous ephedrine (5–20 mg). Heart rates lower than 50 beats/min were regarded as bradycardia and treated with 0.5 mg intravenous atropine. The leg was prepared and

draped, and a tourniquet was routinely used but with no leg holder. Meniscal surgery, plicae resection and chondral abrasion were arthroscopically performed. No patient in either group required general anesthesia to perform surgery due to inadequate spinal block. The times to sensory and motor block resolution, urination, unassisted ambulation, and readiness to home discharge were recorded. Perioperative complications such as nausea, vomiting, and urinary retention were also recorded if present. Globe vesicale was the clinical diagnosis of urinary retention.

The patients were discharged with an escort when their vital signs had been stable for 1 h, and they were well oriented, able to drink, pass urine, dress, and walk with a pair of cane. The patients with significant nausea, pain, or bleeding were kept in hospital. All patients were interviewed by telephone 7 days later and each individual was questioned about possible headache or backache and asked if they would choose the same anesthesia for a similar operation in the future. A headache was categorized as a postdural puncture headache if it was worse on sitting or standing and relieved or reduced by lying flat. Postdural puncture headache was treated with horizontal bed rest, analgesic, and hydration.

The data were analyzed using Student's *t* test, and nonparametric data were analyzed using Mann-Whitney's *U* and Fisher's exact tests. Differences at the level of $P < 0.05$ were considered statistically significant.

Results

The maximum sensory level on the operated side was T10 (T8–T11) in the unilateral group and T10 (T8–12) in the bilateral group (Table 2). Thirty patients (85.7%) in the unilateral group showed pure unilateral spinal block while five patients' spinal block spread to the nondependent side. Motor block of the operated limb was similar in the two groups (Table 2). Except for two patients in the unilateral group all patients had complete motor block on the dependent side.

The mean values of arterial blood pressure and heart rate are shown in Fig. 1. Three patients in the bilateral group developed hypotension, and these patients were treated with ephedrine. No patient in the unilateral group developed hypotension. Bradycardia occurred in two patients in the bilateral group. Three patients in the bilateral group required temporary bladder catheterization due to a delay in recovery of spontaneous urination. Three patients in the bilateral group and two in the unilateral group needed treatment for moderate and severe headache. Complications in both groups are shown in Table 3. In the unilateral group the duration of the sensory and motor blocks was shorter than of the bilateral group. These differences were statistically significant ($P < 0.05$, Table 4).

Table 2 Sensory level, modified Bromage score, and sensory and motor block onset time

	Bilateral group (n=35)	Unilateral group (n=35) (dependent side)	P
Sensory level	T10 (T8–T12)	T10 (T8–T11)	>0.05
Bromage score	3 (2–3)	3 (1–3)	>0.05
Onset time of sensory block (s)	249.42±181.57	251.42±125.37	>0.05
Onset time of motor block (s)	323.25±178.30	315.42±130.03	>0.05

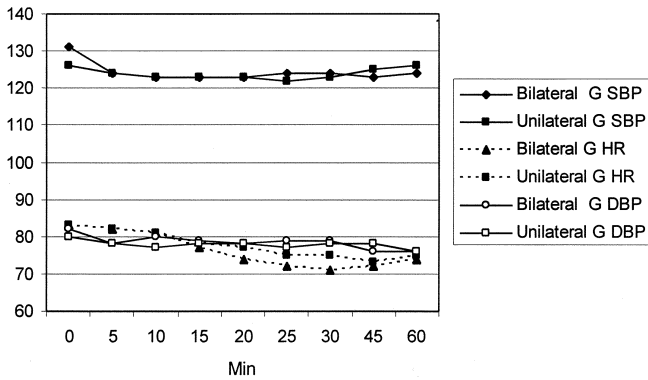


Fig. 1 Systolic blood pressure, diastolic blood pressure, and heart rate. *SBP* Systolic blood pressure (mmHg); *DBP* diastolic blood pressure (mmHg); *HR* heart rate)

Table 3 Complications

	Bilateral group (n=35)	Unilateral group (n=35)	P
Hypotension	3	0	>0.05
Bradycardia	2	0	>0.05
Urinary retention	3	0	>0.05
Nausea, vomiting	3	0	>0.05
Headache	9	6	>0.05
Backache	5	6	>0.05

Table 4 Duration of motor and sensory block and time to discharge from the hospital

	Bilateral group (n=35)	Unilateral group (n=35)	P
The duration of motor block (min)	153.25±73.13	102.48±42.72	<0.05
The duration of sensory block (min)	193.42±73.95	137.68±46.85	<0.05
Time to discharge (min)	252.87±72.20	195.71±45.97	<0.05

The time to discharge from hospital was shorter in the unilateral group than in the bilateral group and, this difference was statistically significant (Table 4). One patient (2.8%) in the unilateral group and four (11.4%) in the bilateral group stated that they would prefer a different anesthetic method if they should need to have surgery in the future.

Discussion

Our data indicate that unilateral spinal anesthesia is a suitable technique in outpatient knee arthroscopy. The main advantage of unilateral spinal anesthesia is the early discharge from the hospital. The patients were mostly satisfied, and no adverse hemodynamic consequences were observed.

Tanasichuk et al. [17] reported that the incidence of hypotension in cases undergoing unilateral spinal anesthesia was 18% vs. 50% in cases undergoing bilateral spinal anesthesia. To produce unilateral block Kuusniemi et al. [14] used hypobaric and hyperbaric bupivacaine, and they reported minimal hemodynamic changes; in their study hypotension occurred in only 5.0% and bradycardia in 1.7% of patients. Kim and Moneta [12] injected arthroscopy patients with 0.75% bupivacaine in doses of 6, 8, and 10 mg for unilateral spinal anesthesia. They reported the mean analgesia duration as 93, 123, and 147 min, respectively, and no cases of hypotension were observed with these doses of bupivacaine. We found that the regression of sensory block after intrathecal injection of 7.5 mg 0.5% hyperbaric bupivacaine required 137 min.

Iselin-Chaves et al. [10] reported no cases of unilateral spinal anesthesia when injecting 12 mg hyperbaric tetracaine. In almost all of their cases spinal block spread to the nondependent side as well. Casati et al. [4] demonstrated that the use of highly concentrated solutions of hyperbaric bupivacaine did not provide clinical advantages in obtaining unilateral spinal anesthesia. Kuusniemi et al. [14] reported hyperbaric bupivacaine provides more unilateral spinal block than the plain bupivacaine. Pittoni et al. [15] studied hyperbaric spinal bupivacaine anesthesia for ambulatory surgery. In this study after administering doses of 5–12 mg hyperbaric bupivacaine unilateral spinal anesthesia was achieved in 88% of the cases. However, they maintained the lateral decubitus position of the patients for 30 min. Kuusniemi et al. [13] spent 20 or 30 min time in the lateral position for unilateral spinal anesthesia. They obtained 39–65% unilateral spinal block. Keeping the patients in lateral decubitus position for 20–30 min as in this article [13] should be considered unsuitable in terms of time saving in ambulatory surgery. For ambulatory surgery a shorter time in the lateral position is most suitable. We obtained 85.7% unilateral spinal block in this study. In 14.3% of cases spinal block also spread to the nondependent side. To obtain unilateral spinal block we selected 10 min in the lateral position as we reported in the previous study that 15 min spent in the lateral position does not provide benefits over 10 min [6]. We suggest keeping the patients in lateral decubitus position for a shorter time after dural puncture in contrast to other investigators to obtain an advantage in patient turnover.

Pittoni et al. [15] reported postdural puncture headache in only one patient (0.8%) in the group using the 22-gauge Sprotte spinal needle. Kuusniemi et al. [13] reported that none of the patients developed a postspinal headache or urinary retention. We observed more postdural puncture headache than other investigators. This could be explained by the fact that the average age of our study groups are lower than in other studies. Another possible explanation of higher incidence of headache in our study is the QINCKE type spinal needle used in spinal anesthesia. Fanelli et al.

[7] reported no postdural puncture headache or any other neurological complication at the 24-h or 7-day postoperative follow-up. They used the 25-gauge Whitacre spinal needle. It was very interesting not to encounter any postdural puncture headache even though their study group were young.

Spinal anesthesia causes a clinically significant disturbance in bladder function due to interruption of the micturition reflex [11]. Potentially harmful urinary retention can be suspected with the presence of severe pain, bradycardia, hypotension, or hypertension, heart dysrhythmias, or vomiting. Urinary retention can produce irreversible detrusor damage leading to incontinence and recurring

urinary infections [8]. Kamphuis et al. [11] reported that bladder function remained impaired until the block had regressed to the third sacral segment. They found the use of short-acting local anesthetics for spinal anesthesia to be preferable. In our study there was no urinary retention in the patients who received unilateral spinal anesthesia. This may be related to the unilateral spinal block being administered with a low dose of bupivacaine.

We conclude that unilateral spinal anesthesia with hyperbaric bupivacaine is preferable for outpatient arthroscopic knee surgery when comparing bilateral spinal anesthesia with respect to complication rate, discharge time, and patient tolerance.

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