Unilateral Spinal Anesthesia Using a 26-gauge Quincke Spinal Needle

Department of Anesthesiology and Pain Medicine, Seoul National University Bundang Hospital, Seongnam; *Department of Anesthesiology and Pain Medicine, Dankook University Hospital, Cheonan, Korea

Mija Yun, M.D., Yong Seok Oh, M.D., Seung Whan Kang, M.D.*, Dong Sup Whang, M.D.*, and Kayoung Rhee, M.D.

**Background:** We evaluated whether the unilateral spinal anesthesia using a 26-gauge Quincke needle provides more adequate or hemodynamically stable spinal anesthesia than the conventional spinal anesthesia in orthopedic patients.

**Methods:** Fifty-eight ASA 1 or 2 patients aged from 18 to 65 years undergoing unilateral lower limb surgery were included. All patients were placed in the lateral position with the side to be operated on dependent and received a 8 mg 0.5% hyperbaric bupivacaine through a 26-gauge Quincke spinal needle for 80 seconds. Local anesthetic was injected with the needle orifice turned toward the dependent side, then the immediate supine position (conventional group, n = 34), or the lateral position (unilateral group, n = 24) was maintained for 15 minutes. Hemodynamic variables, as well as loss of cold, pinprick sensation and motor block on both sides were recorded.

**Results:** All the 23 patients in the unilateral group had adequate spinal anesthesia, whereas 6 out of 34 patients of the conventional group (17.6%) had inadequate to failed spinal anesthesia (P < 0.05). There were significant differences in the degree of motor block on the dependent side of lower extremities between the two groups. Motor block of grade 0 to 1 on the dependent side were 23.5% and 0% in the conventional and unilateral group, respectively (P < 0.05). Unilateral sympathetic or sensory block were not observed in the unilateral group. No differences in blood pressure, heart rate changes were observed between the two groups.

**Conclusions:** The present study does demonstrate clinically relevant advantages of a lateral position for 15 minutes, either in terms of adequacy of spinal anesthesia or differential motor block using a 26-gauge Quincke spinal needle in orthopedic patients.

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**Key Words:** spinal anesthesia, unilateral, Quincke needle.

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**INTRODUCTION**

Asymmetric distribution of spinal block toward the surgical side is advantageous for minimizing cardiovascular effects of spinal block.1-4 Most of the studies about unilateral anesthesia used pencil-point needle.5-9 The tip of the common Quincke needle have long bevel that incorporate a terminal orifice and is more easy to differentiate bone from ligament than pencil point needle in clinical bases.10 Unlike pencil point injections, however, injection through a Quincke needle does not make streaming and directional flow in the direction of the needle hole,9 which minimizes the mixing of hyperbaric bupivacaine with the CSF and improves the unilateral distribution of spinal anesthesia.11 There have been no attempts that compared the adequacy or hemodynamic effects of unilateral spinal anesthesia with the conventional anesthesia using a Quincke needle. A few of the studies that used a Quincke needle investigated the optimal duration of the lateral decubitus position12 and the dose of local anesthetic solution to perform unilateral spinal anesthesia.12,14 This study was undertaken to evaluate whether the unilateral spinal anesthesia using a 26-gauge Quincke needle provides any advantages in terms of adequacy or hemodynamic stability than the conventional spinal anesthesia in orthopedic patients.
METHODS

After the study protocol had been approved by the local Ethical Committee, written informed consent was obtained from 58 ASA 1-2 patients, aged from 18 to 65 years, receiving spinal anesthesia for elective orthopedic surgery involving one lower limb only (e.g., toes, foot, and ankle surgery). Patients with any absolute contraindication for regional anesthesia were excluded. Standard monitoring was used throughout the study, including noninvasive arterial blood pressure, heart rate, and pulse oximetry. After arrival in the operating theater, a crystalloid preload (lactated Ringer’s solution, 7 ml/kg) was intravenously infused without premedication and then baseline values of heart rate and arterial blood pressure were recorded.

Patients were placed in the lateral position with the limb to be operated on the dependent position. The vertebral column was positioned before dural puncture and was maintained as horizontal as possible by tilting the operating table or putting a pillow under the patient’s shoulder. Dural puncture was performed at the L3-L4 or L4-L5 interspace using a 26-gauge Quincke spinal needle (Spinocan, B. Braun, Sao-Goncalo, Brasil) with a midline approach. Using sealed envelopes, patients were then randomly allocated to one of two groups. In the conventional group (n = 34), after free flow of cerebrospinal fluid (CSF) had been observed, the needle orifice was turned toward the dependent side and 8 mg (1.6 ml) of 0.5% hyperbaric bupivacaine (Marcaine® Spinal 0.5% Heavy, AstraZeneca, Sodertalje, Sweden) was injected over 80 seconds; then the patients were immediately turned to the supine position and were kept supine position for 15 minutes. In the unilateral group (n = 24), the needle orifice was turned toward the dependent side and the same dose of 0.5% hyperbaric bupivacaine was injected over the same interval without further CSF aspirations; the lateral position was then maintained for 15 minutes before patients were turned to the supine position.

Because the two treatment groups had different positions during the first 15 minutes after dural puncture, measurements were performed by an unblinded observer until patients of the unilateral group were placed in the supine position, and then all measurements were made by a trained independent observer, blinded to the spinal anesthesia technique. Sympathetic and sensory block was evaluated by loss of cold (ice pack) sense and pinprick (26-gauge hypodermic needle), respectively. Motor block was evaluated using a modified Bromage scale (0 = no motor block; 1 = hip blocked; 2 = hip and knee blocked; 3 = hip, knee, and ankle blocked).7) Hemodynamic variables were measured every 3 minutes during the first 15 minutes after dural puncture, then every 5 minutes until the end of surgery. The evolution of sensory and motor blocks was assessed on both dependent and nondependent sides every 15 minutes until the motor block was regressed by one degree on the dependent side. The regression of sensory level by two segments on the dependent side was also recorded.

The adequacy of spinal anesthesia was judged according to the need for supplementary intravenous analgesics required to complete surgery: adequate spinal anesthesia = no additional analgesics required to complete surgery; inadequate spinal anesthesia = need for additional analgesics (0.1 mg intravenous fentanyl) required to complete surgery; or failed spinal anesthesia = general anesthesia required to complete surgery.

To calculate the required study size, we took into account the incidence of hypotension during conventional or asymmetric hyperbaric spinal block,6 accepting an α error of 5% and a β error of 20%. Based on these figures, the required study size ranged from 13 to 16 patients per group.

Continuous variables are presented as mean ± SD; ordinal data are presented as median (range) or as count (percentage). Statistical analysis was performed using the program SPSS® 11.0 (SPSS Inc., USA) version. After normal distribution of collected data had been checked, unpaired t-test was used to compare continuous variables in the two treatment groups. The differences in hemodynamic changes from baseline value at each time points between the two groups were analyzed by t-test. The dichotomous variables and the evolution of sensory and motor blocks was analyzed by Mann-Whitney test or Spearman correlation. A value of P less than 0.05 was considered significant.

RESULTS

The two groups of patients were comparable with respect to the demographic variables, duration of surgery (Table 1). Six patients (17.6%) in the conventional group had inadequate to failed spinal block, whereas all the 23 patients in the unilateral group had adequate spinal block (P < 0.05). One case in the unilateral group was excluded from the study because of the difficulty in checking the block level by a surgical drape.

Table 2 shows the maximum sympathetic level and motor block measured on both the dependent and nondependent sides.
and the time taken to reach them, as well as the time lasting from local anesthetic injection to both regression of sympathetic level by two segments and regression of motor block by one degree.

In the unilateral group, all of the patients showed bilateral loss of sympathetic and pinprick sensation during the study period. The level of maximum sympathetic block on the dependent side was higher in the unilateral group than in the conventional group (P < 0.05). The maximum sympathetic levels on the both sides of the conventional group were reached faster than the unilateral group (P < 0.05). The regression times of sympathetic level by two segments on the dependent side were not different between the two groups. The loss of pinprick sensation on the dependent side in the unilateral group (T6 [T3-L1]) was more cephalad than the conventional group (T10 [C4-T12]) (P < 0.05). But there were no differences in time to reach the maximum sensory level on the both sides between the two groups.

There were significant differences in the degree of motor block on the dependent side of lower extremity between the two groups (0/1/2/3 = 7/1/6/20, 0/1/1/22 on the dependent side of conventional and unilateral group, respectively, P < 0.05. 0/1/2/3 = 5/5/8/16, 6/8/5/4 on the nondependent side of conventional and unilateral group, respectively, P > 0.05). The maximum motor block on the nondependent side of the conventional group was reached faster than the unilateral group (P < 0.05). The regression of motor block by one degree on the dependent side was not different between the two groups.

No differences were observed in the mean changes from baseline values of arterial blood pressure and heart rate between the two groups (Fig. 1). The incidence of hypotension was not different between the two groups (2 patients [5.8%] in the conventional group and 1 patients [4.3%] in the unilateral group). No differences were observed in the incidence of bradycardia (1 patient in each group).

Fentanyl administration was 475μg and 0μg in the conventional and the unilateral group, respectively. It is related with the higher percentage of inadequate to failed spinal block in the conventional group (17.6%) than the unilateral group (0%). Postoperatively, 5 (14.7%) and 3 (13.0%) cases of urinary retention were reported in the conventional and the unilateral group, respectively.

**DISCUSSION**

The present investigation showed that the unilateral spinal anesthesia using a 8 mg of 0.5% hyperbaric bupivacaine slowly injected into patients placed in the lateral position for 15 minutes, did provide more adequate spinal anesthesia than

### Table 1. Demographic Variables and Intraoperative Adequacy of Spinal Anesthesia

<table>
<thead>
<tr>
<th></th>
<th>Conventional (n = 34)</th>
<th>Unilateral (n = 23)</th>
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</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>39.6 ± 12.3</td>
<td>36.3 ± 11.3</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>69.4 ± 10.9</td>
<td>68.1 ± 11.4</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>168.5 ± 7.8</td>
<td>169.0 ± 8.9</td>
</tr>
<tr>
<td>Gender (M/F)</td>
<td>24 / 10</td>
<td>18 / 5</td>
</tr>
<tr>
<td>ASA physical status</td>
<td>1 (1-2)</td>
<td>1 (1-2)</td>
</tr>
<tr>
<td>Duration of surgery (min)</td>
<td>59.4 ± 28.5</td>
<td>53.0 ± 27.5</td>
</tr>
<tr>
<td>Adequacy of spinal block (adequate/inadequate/failed)</td>
<td>28 / 1 / 5</td>
<td>23 / 0 / 0*</td>
</tr>
</tbody>
</table>

Data are expressed as mean ± SD, with the exception of gender and block adequacy (number) and ASA physical status (median (range)). *P < 0.05 compared with the conventional group.

### Table 2. Sympathetic and Motor Block on both Dependent and Nondependent Sides in Patients Receiving either an Unilateral or Conventional Spinal Anesthesia

<table>
<thead>
<tr>
<th></th>
<th>Conventional (n = 34)</th>
<th>Unilateral (n = 23)</th>
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</thead>
<tbody>
<tr>
<td>Level of block and time (min)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sympathetic level (D)</td>
<td>T10 (C4-T12)</td>
<td>T6 (T2-T11)*</td>
</tr>
<tr>
<td>Maximum sympathetic level (ND)</td>
<td>T8 (C4-T12)</td>
<td>T6 (T2-L3)</td>
</tr>
<tr>
<td>Time to reach maximum sympathetic level (D)</td>
<td>21.6 ± 11.1</td>
<td>29.3 ± 12.3*</td>
</tr>
<tr>
<td>Time to reach maximum sympathetic level (ND)</td>
<td>21.6 ± 9.1</td>
<td>31.9 ± 13.7*</td>
</tr>
<tr>
<td>Regression of sympathetic level by two segments (D)</td>
<td>81.6 ± 29.2</td>
<td>87.6 ± 22.5</td>
</tr>
<tr>
<td>Maximum motor block (D)</td>
<td>3 (0-3)</td>
<td>3 (2-3)*</td>
</tr>
<tr>
<td>Maximum motor block (ND)</td>
<td>3 (0-3)</td>
<td>1 (0-3)</td>
</tr>
<tr>
<td>Time to reach maximum motor block (D)</td>
<td>17.0 ± 6.6</td>
<td>16.9 ± 5.1</td>
</tr>
<tr>
<td>Time to reach maximum motor block (ND)</td>
<td>19.5 ± 10.5</td>
<td>30.8 ± 19.4*</td>
</tr>
<tr>
<td>Regression of motor block by one degree (D)</td>
<td>108.0 ± 35.7</td>
<td>125.7 ± 52.4</td>
</tr>
</tbody>
</table>

Continuous variables are presented as means ± SD; ordinal data are presented as median (range). *P < 0.05 compared with the conventional group. D: dependent side, ND: nondependent side.
the conventional spinal anesthesia, even though none of the patients showed unilateral sympathetic or sensory block in both groups. Fourteen out of 23 patients (60.8%) had motor block of grade 0 to 1 on the nondependent side in the unilateral group. This differential block is interesting and would be controlled by a needle size, injection speed or dose of local anesthetic in attempting spinal anesthesia using a Quincke type needle. Lateralization for 15 minutes, however, seems to make local anesthetic contact with nerve roots mainly on the dependent side for only a short period of operation because the regression time of sympathetic and sensory level on the dependent side was not longer than the conventional group.

Four simultaneous factors have been suggested to improve the lateral distribution of a hyperbaric anesthetic solution; a lateral position, a small anesthetic dose, a slow speed of injection, and the choice of a directional spinal needle. In the present study, a dose of 8 mg of 0.5% heavy bupivacaine, lateral position for 15 min, slow injection for 80 seconds were applied strictly to all patients in the unilateral group.

Meyer et al. injected the hyperbaric bupivacaine via a 29-gauge Quincke needle with a pump-controlled injection flow of 1 ml/min and unilateral sympathetic and motor block were 69% and 77%, respectively. However, the absolute changes in blood pressure associated with spinal anesthesia in patient population were small and of minor clinical importance in the above study. Although the 0.5% hyperbaric bupivacaine injected over 80 seconds, the injection was performed manually via a 26-gauge Quincke needle, therefore, the changes in injection speed, larger needle size and associated turbulence cannot be excluded in our study.

There was no more hemodynamic stability in the unilateral group than in the conventional group in our study. No unilateral distribution of sympathetic block, small dose of heavy bupivacaine and healthy population were considered to be contributing factors for this result. The hemodynamic effects of spinal anesthesia are mainly a result of both the resistance and capacitance changes induced by the block of preganglionic sympathetic fibers. In the present investigation, no direct measurements of changes in sympathetic activity, such as

Fig. 1. Changes of arterial blood pressure and heart rate during the first 60 minutes after either an unilateral (n = 34) or a conventional (n = 23) spinal anesthesia. Data are presented as mean ± SD. There were no differences in DSAP, DHR between the two groups except change of diastolic blood pressure at 60 min (P < 0.05). DSAP: change of systolic arterial pressure from baseline value, DDAP: change of diastolic arterial pressure from baseline value, DHR: change of heart rate from baseline value. *P < 0.05 compared with the conventional group.
thermography or skin conductance response, were used. However, the presence of cold sensation strictly correlates with the function of C fibers.  

The time taken to achieve the maximum sympathetic level on the both sides in the unilateral group was delayed. The slower onset time coupled with the reduced extent of sympathetic block probably allowed unilateral group patients to activate more effective homeostatic vascular mechanisms than those patients receiving conventional bilateral spinal anesthesia. The more cephalic spread of spinal sympathetic block on the dependent side of the unilateral group (T6 [T2-T11]) compared with the conventional group (T10 [C4-T12]) seems to offset the effect by delayed sympathetic block in our study.

This study size was too small to evaluate the incidence of hypotension and bradycardia since we took into account the incidence of hypotension of studies that used Whitacre needle. Sufficiently powered studies should be performed to investigate the anesthetic technique to improve the unilateral anesthesia and hemodynamic stability using a Quincke needle.

There were no differences in the incidence of urinary catheterization between the two groups. It is related with the bilateral sympathetic and pinprick sensory loss, and similar time to regression of sympathetic, sensory and motor block between the two groups.

In conclusion, the present study does demonstrate clinically relevant advantages of a lateral position for 15 min, either in terms of adequacy of spinal anesthesia or differential motor block using a 26-gauge Quincke needle in orthopedic patients.

REFERENCES


