Unilateral spinal anaesthesia for varicose vein surgery: a comparison of hyperbaric bupivacaine 7.5 mg versus hyperbaric bupivacaine 5 mg + fentanyl 25 μg

Abstract

**Background and Purpose:** Unilateral spinal anaesthesia restricts the distribution of spinal block preferentially to the operative side. Intrathecal coadministration of opioids increases sensory block without enhancing motor or sympathetic block. In this study we compared unilateral hyperbaric bupivacaine spinal anaesthesia with or without fentanyl in patients undergoing varicose vein surgery.

**Material and Methods:** 40 ASA I-II adults randomly received unilateral spinal anaesthesia with hyperbaric bupivacaine 7.5 mg (Group B, n=20) or hyperbaric bupivacaine 5 mg + fentanyl 25mg (Group BF, n=20). Sensory and motor block, hemodynamic data and side-effects were recorded.

**Results:** Maximum level of sensory block on operative leg was Th11 (Th12-Th8) in Group B and Th12 (Th12-Th10) in Group BF, P=0.09. Complete motor block had 12 (60%) Group B and 4 (20%) Group BF patients, P=0.02. Total regression of motor block required 127 ± 31 min in Group B and 87 ± 18 min in Group BF, P<0.001. Maximum decrease of systolic arterial pressure from start value was 19 ± 9% in Group B and 16 ± 6% in Group BF, P=0.32 and of heart rate 23 ± 10% and 17 ± 7%, P=0.06, respectively. Pruritus had 9 (45%) Group BF patients, P = 0.001.

**Conclusion:** Unilateral hyperbaric bupivacaine 5mg + fentanyl 25 mg spinal anaesthesia provides adequate intraoperative sensory block in operated leg and results in similar cardiovascular stability, less intense motor block and faster motor recovery than unilateral hyperbaric bupivacaine 7.5 mg spinal anaesthesia in patients undergoing varicose vein surgery.

INTRODUCTION

Conventional-dose bilateral spinal anaesthesia, providing fast onset and adequate sensory and motor block, has been widely used for varicose vein surgery for many years. However, due to prolonged block recovery, urinary retention and high degree of cardiovascular instability, its use has not been suitable in cardiac risk patients and short and outpatient procedures.

Unilateral spinal anaesthesia, using small doses of hypobaric or hyperbaric local anaesthetic solutions slowly injected through directional...
needles and lateral decubitus position maintained for a certain period, restricts the distribution of spinal block preferentially to the operative side (1, 2). Unilateral distribution of spinal block results in fewer hemodynamic side effects with higher cardiovascular stability, better patient acceptance, increased postoperative autonomy, easier nursing during and after the procedure and reduced delay in patient discharge (3).

Combination of local anaesthetic and opioid administered together intrathecally has a potent synergistic analgesic effect (4). Intrathecal opioids greatly enhance subtherapeutic doses of local anaesthetic and make it possible to achieve successful spinal anaesthesia by using otherwise inadequate doses of local anaesthetic (5).

In this prospective, randomized, double-blind study we compared the clinical profile of unilateral spinal anaesthesia produced with either 7.5 mg of hyperbaric bupivacaine or 5 mg of hyperbaric bupivacaine coadministered with 25 µg of intrathecal fentanyl in patients undergoing varicose vein surgery.

MATERIAL AND METHODS

After obtaining an approval from the Institutional Ethics Committee and written informed consent, a total of 50 American Society of Anesthesiologist (ASA) physical status I and II adult patients undergoing varicose vein surgery under unilateral spinal anaesthesia, were enrolled in study. Patients with contraindication to regional anaesthesia (1 patient) or to any drug used in study (1 patient), body mass index > 32 (2 patients), peripheral neuropathy (2 patients) and patients receiving chronic analgesic therapy (4 patients) were excluded.

Remaining 40 patients were premedicated with peroral midazolam (7.5 mg) 30 minutes before block placement. A 20-Gauge intravenous cannula was inserted on the forearm and intravenous infusion of 7 ml/kg of Ringer solution was started after arrival in the operating room.

Standard intraoperative monitoring, including continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous electrocardiogram, heart rate, pulse oxymetry and noninvasive arterial blood pressure, was applied. Using a continuous elec...
The upper level of sensory block on operative leg was Th11 (Th12 – Th8) in group B and Th12 (Th12 – Th10) in group BF, $P = 0.09$. The mean time to achieve adequate surgical anesthesia was $6 \pm 2$ and $9 \pm 4$ min in group B and group BF, respectively, $P = 0.04$. None of the patients in both groups required fentanyl or propofol supplementation. Strictly unilateral motor block had 16 (80%) group B and 19 (95%) group BF patients, $P = 0.34$.

Maximal modified Bromage score on non-operative leg was 1 in all 4 group B and in 1 group BF patient with bilateral distribution of spinal block. Complete motor block (modified Bromage score 3) on operative side had 12 (60%) group B and 4 (20%) group BF patients, $P = 0.02$. The mean modified Bromage scores on operative leg during 180 min after spinal injection are shown in Figure 1. Motor block on the operative side was more profound in group B than in group BF at all testing times, but 150 and 180 minutes after spinal injection. Complete motor recovery 120 min after spinal injection had 11 (55%) group B and all 20 (100%) group BF patients, $P = 0.001$. Total regression of motor block required 127 ± 31 min in group B and 87 ± 18 min in group BF, $P < 0.001$. Time to first micturition was 265 ± 89 min in group B and 292 ± 89 min in group BF, $P = 0.34$, and time to first micturition was 349 ± 107 and 362 ± 17 min, $P = 0.54$, respectively.

There were no significant differences between the 2 groups regarding systolic and diastolic arterial pressure (Figure 2), mean arterial pressure and heart rate (Figure 3) during all 60 minutes after spinal injection. Maximum decrease in systolic arterial pressure from baseline was 19 ± 9% in group B and 16 ± 6% in group BF, $P = 0.32$, and in heart rate 23 ± 10% and 17 ± 7%, $P = 0.06$, respectively. Clinically relevant hypotension was reported in 4 (20%) group B patients only, $P = 0.11$, and was effectively treated with rapid intravascular volume expansion. Bradycardia was reported and effectively treated with 0.5 mg of intravenous atropin in 2 (10%) group B and 1 (5%) group BF patients, $P = 0.99$. Pruritus was documented in 9 (45%), $P = 0.001$, nausea and vomiting in 2 (10%), $P = 0.49$ and sedation score > 2 in 2 (10%), $P = 0.99$ group BF patients only. No case of respiratory depression, postural puncture headache or neurological complications were reported.

**DISCUSSION**

The dose of local anaesthetic usually used for spinal block is an overdosage in relation to the minimum concentration required to block various types of nerve fibres. New spinal anaesthetic techniques focus on the possibility to control the spread of intrathecal drug, thereby restricting the distribution of spinal block just to the area which is necessary for the surgery. Unilateral spinal anaesthesia, using small doses of hyperbaric local anaesthetic solution and limiting the block only to the operative side provides higher hemodynamic stability and makes good option for elderly, compromised and ambulatory surgery patients (6–8).

Unfortunately, in our country, commercial preparations of hyperbaric bupivacaine are not currently available on the market. So, in this study hyperbaric anaes-

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**TABLE 1**

<table>
<thead>
<tr>
<th>Patients characteristics and operation time.</th>
<th>Group B (n = 20)</th>
<th>Group BF (n = 20)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>47 ± 14</td>
<td>47 ± 11</td>
<td>0.95</td>
</tr>
<tr>
<td>Gender (M / F)</td>
<td>8 / 12</td>
<td>7 / 13</td>
<td>0.99</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>79 ± 11</td>
<td>79 ± 13</td>
<td>1.0</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>171 ± 7</td>
<td>167 ± 10</td>
<td>0.19</td>
</tr>
<tr>
<td>ASA I / II</td>
<td>11 / 9</td>
<td>10 / 10</td>
<td>0.99</td>
</tr>
<tr>
<td>Operation time (min)</td>
<td>49 ± 16</td>
<td>44 ± 13</td>
<td>0.29</td>
</tr>
</tbody>
</table>

Values are mean ± standard deviation or number of patients; ASA: American Society of Anesthesiologist

**TABLE 2**

<table>
<thead>
<tr>
<th>Basal hemodynamic parameters.</th>
<th>Group B (n = 20)</th>
<th>Group BF (n = 20)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAP (mmHg)</td>
<td>131 ± 18</td>
<td>131 ± 16</td>
<td>0.84</td>
</tr>
<tr>
<td>DAP (mmHg)</td>
<td>78 ± 12</td>
<td>79 ± 10</td>
<td>0.81</td>
</tr>
<tr>
<td>MAP (mmHg)</td>
<td>98 ± 15</td>
<td>97 ± 16</td>
<td>0.98</td>
</tr>
<tr>
<td>HR (bpm)</td>
<td>79 ± 16</td>
<td>73 ± 11</td>
<td>0.21</td>
</tr>
</tbody>
</table>

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**Figure 1. Modified Bromage score on operative leg during 180 min after spinal injection.**

**Figure 2. The mean systolic arterial pressure (SAP) and diastolic arterial pressure (DAP) during the first 60 minutes after spinal injection.**
thetic solutions were prepared by adding 0.3 ml of 50% glucose to 0.5% plain bupivacaine with or without fentanyl, achieving a final concentration of 8.33% glucose. Hallworth et al. demonstrated that the addition of glucose to bupivacaine produced solutions of predictable density in linear manner, and also, that the final glucose concentration, and not opioid, largely determined a solution’s density. They demonstrated that the mean density of fentanyl was 0.99959 g/ml and the density of plain bupivacaine 0.99950 to 0.99970 g/ml (9). Because the densities of the two agents are virtually identical, the addition of fentanyl to bupivacaine-glucose mixture has negligible effect on the final density of the solution. The use of small dose of local anesthetics for spinal anesthesia can lead to a higher failure rate and Valanne et al. reported 6% and 2% failed spinal blocks when 4 and 6 mg of hyperbaric bupivacaine were used, respectively (10). In our prospective, randomized, double-blind study, unilateral spinal anesthesia was produced with either 7.5 mg of hyperbaric bupivacaine or 5 mg of hyperbaric bupivacaine coadministered with 25 μg of intrathecal fentanyl and adequate surgical anesthesia was achieved in all 40 patients in both groups.

The onset time of achieving adequate surgical anesthesia was only slightly prolonged in bupivacaine-fentanyl group and this 3-minute difference was statistically significant, but clinically negligible. Although the upper level of sensory block on operative leg was one dermatome lower in group BF than in group B (Th12 vs. Th11), the difference was not found to be statistically different (P=0.09).

Strictly unilateral motor block was observed in 80% of the patients who received 7.5 mg of hyperbaric bupivacaine and the result is consistent with previous study that also reported unilateral motor paralysis with the same dose of local anesthetic in 80% of the patients while in the lateral position (11). In patients who received 5 mg of hyperbaric bupivacaine together with 25 μg of fentanyl, strictly unilateral motor block was observed in 95% of the patients.

When producing unilateral spinal anesthesia with 4 mg and 6 mg of hyperbaric bupivacaine, Borghi et al. reported complete unilateral motor block in 97% and 93% of the patients, respectively (12).

Complete motor block (modified Bromage score 3) was more often in group B than in group BF, 60% vs 20%, due to the higher concentrations of local anesthetic achieved near the nerve roots of the operated limb. Also, motor block was less intense and lasted shorter when a small dose of local anesthetic-fentanyl combination was applied. The similar was observed in study reported by Korhonen et al. in which intrathecal hyperbaric bupivacaine 3 mg + fentanyl 10 μg and hyperbaric bupivacaine 4 mg were compared (13). In a dose finding study of unilateral spinal block for outpatient knee arthroscopy, Borghi et al. demonstrated faster recovery profile when 4 mg of hyperbaric bupivacaine was administered than when 6 mg or 8 mg dose were used (12). Complete regression of spinal anesthesia required 71 ± 20, 82 ± 25 and 97 ± 37 min, respectively, and in our study, 87 ± 18 and 123 ± 31 min when 5 mg and 7.5 mg of hyperbaric bupivacaine were applied.

In both groups, unilateral spinal anesthesia provided stable cardiovascular profile with minimal hemodynamic disturbance, due to the low maximum sensory block recorded on the operative side. Similar results have been reported in previous studies which demonstrated high degree of hemodynamic stability when unilateral spinal anesthesia with small doses of hyperbaric bupivacaine were used (6–8).

In the present investigation, no case of urinary retention requiring bladder catheterization was reported, whereas Fanelli et al. documented an incidence of urinary retention of 2% in patients receiving unilateral spinal anesthesia with 8 mg of hyperbaric bupivacaine (6).

Postoperative pain relief was adequate in all 40 patients and time to first analgesics did not differ between the two groups. Coadministration of 25 μg of fentanyl to 5 mg of hyperbaric bupivacaine provided adequate analgesia, but resulted in pruritus in 45% and in postoperative nausea and vomiting in 10% of the patients. Ben David et al. reported the similar incidence of pruritus in up to 41% and of postoperative nausea and vomiting in up to 18% of the patients when 25 μg of intrathecal fentanyl was administered to 20 mg of spinal lidocaine (4). In our study, no case of postdural puncture headache or neurological complications in either group were noticed.

In conclusion, both unilateral hyperbaric bupivacaine 7.5 mg and unilateral hyperbaric bupivacaine 5 mg + fentanyl 25 μg spinal anesthesia provide adequate intraoperative sensory block in operated leg and result in similar cardiovascular stability in patients undergoing varicose vein surgery. However, local anesthetic-opioid combination is found to be superior because it provides less intense motor block and faster motor recovery, which permits fast tracking and shorter stay in post anesthesia care unit.

REFERENCES


