Comparison between ultrasound-guided sciatic–femoral nerve block and unilateral spinal anesthesia in below-knee amputation surgery

Ayman Esmail Hussiena, Mohamed Abd Elgawad Abd Elhalima, Mohamed Shehata Zaradb

Objectives To compare unilateral spinal anesthesia and ultrasound-guided combined sciatic–femoral nerve block (SFB) regarding hemodynamic stability, quality of nerve block, bladder function, and time-to-readiness for discharge (TRD) in below-knee amputation surgery.

Patients and methods A total of 80 patients who underwent knee amputation surgery (40 per group) were enrolled in the study. They were randomly assigned to one of two groups. Group A received 2 ml (10 mg) of 0.5% levobupivacaine, and group B (SFB) received 25 ml contains 10 ml of 2.0% lidocaine, 10 ml of 0.5% levobupivacaine, and 5 ml of saline (15 ml of femoral and 10 ml of sciatic nerve block). Surgical anesthesia time, time of operation, total time of anesthesia, time-to-first spontaneous urination, time-to-first analgesia, TRD, and patient satisfaction were recorded.

Results Onset of sensory and motor blocks was significantly shorter in group A compared with group B, whereas the recovery time for sensory and motor blocks was longer in group B compared with group A. In the group A, time-to-first analgesia was significantly shorter than the SFB group B; time-to-first spontaneous urination and TRD in the group A were significantly longer than the SFB group B. Pain score was highly significant lower in group B compared with group A after surgery.

Conclusion SFB provided sufficient sensory blockage, duration, patient satisfaction, and postoperative analgesia than the unilateral spinal anesthesia.


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Keywords: below-knee amputation, pain, postoperative outcomes, sciatic–femoral nerve block, spinal anesthesia, ultrasound-guided

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Introduction

Patients with nontraumatic lower extremity amputation, such as knee amputation, usually have multiple comorbidities such as diabetes mellitus and cardiovascular and renal dysfunctions [1,2]. In prior studies, the operations were successfully performed under ultrasound-guided combination of femoral and sciatic nerve blocks [1,2].

They are at high risk of surgical morbidity and mortality. It is intended for prompt protection of infectious origin when performed as an emergency in an excessive soft tissue or bone disease. At this stage of presentation, patients are in severe sepsis with multiorgan dysfunction associated with poor comorbidity, leading to high risk of perioperative complications.

In one study, an individual with American Society of Anesthesia level 4 in nontraumatic lower extremity amputation was associated with a more than four-fold increase in 30-day mortality and a double increase in long-term mortality [2]. Long-term survival is dismal for those with knee amputation [3].

Regional approaches to intraoperative anesthesia and postoperative analgesia were used whenever possible.

Therefore, local anesthetics are the most widely used drugs, but they are short lived and can lead to undesirable effects such as motor block and hypotension [3]. Regional anesthesia techniques are used as an alternative to general anesthesia in the below-knee amputation procedures [4,5]. It is generally accepted that peripheral nerve blocks and spinal anesthesia offer sufficient anesthesia and postoperative analgesia and satisfaction compared with general anesthesia [5,6].

In particular, unilateral spinal anesthesia is recommended for patients undergoing unilateral lower limb surgery as only the target area is subject to nerve blockage, resulting in early recovery and high patient satisfaction [5,7,8].

In lower limb surgery, the combined sciatic–femoral nerve block (SFB) is also used unilaterally, but it is less...
widely used because it takes longer to perform, involving a higher dose of local anesthetic.

Ultrasound-guided SFB is the ideal technique as it avoids SFB-related adverse effects such as blockage and damage to nerves and structures such as artery and vein and associated, with a number of benefits such as less needle insertion, Improved block performance, short administration time, reduced local anesthetic dosage, and rapid nerve blockage [9,10].

**Aim**

In the present randomized study, unilateral spinal anesthesia was compared with SFB in patients undergoing knee amputation surgery in terms of reliability of hemodynamic parameters, performance of the nerve block, function of the bladder, adverse effects, and readiness for discharge.

**Patients and methods**

**Patient population**

*Ethical approval and consent*

This was prospective randomised study enrolled patients between 50 and 70 years of age with an American Society of Anesthesiologists clinical classification III–IV who were scheduled to undergo elective surgery for below-knee amputation. This study was carried out in El-Meqatt Hospital and Alhussien Hospital Al-Azhar University between January 2018 and December 2018 after obtaining informed and written consent and approval from ethics committee at the Faculty of Medicine at Al-Azhar University.

*Consent of publication*

All consents for publication have been taken.

*Exclusion criteria*

Allergies, bleeding disorders, acute infections, neurological disease, structural defects in the spinal cord, respiratory and heart disease, morbid obesity, and Allergy to local anesthesia were the exclusion criteria.

The patients were randomized into two classes using a computer-generated randomization table: group A and the SFB group B (Fig. 1).

**Outcome assessment**

*The primary outcome*

The primary outcome of the experiment was block frequency with respect to sensory and motor blockade start and duration.

*The secondary outcome*

The secondary outcomes of the study were hemodynamic stability, postoperative analgesia, and incidence of complications.

**Anesthetic procedure**

Spinal anesthesia was achieved in the group A by injecting 2 ml (10 mg) of 0.5% levobupivacaine at the level of the lumbar L3–L4 through a 25-G spinal needle in the left or right lateral decubitus position for 15 min.

With the aid of an ultrasonic nerve stimulator (Fig. 2), the SFBs were obtained in the group B using a 25 ml mixture consisting of 10 ml of 2.0% lidocaine, 10 ml of 0.5% levobupivacaine, and 5 ml of saline (15 ml femoral and 10 ml sciatic nerve block).

For all patients, medical history and a complete physical examination are evaluated. Hemodynamic
parameters were reported for ECG, systolic and diastolic blood pressures, and heart rate. Hypotension was treated by incremental intravenous doses of 3 mg ephedrine and intravenous fluid. Bradycardia was treated by 0.3–0.6 mg of intravenous atropine.

Surgical anesthesia time (SAT) in group A was described as complete sensory loss with complete motor blockage at 12-level thoracic. SAT was identified in group B as the complete motor block and sensory of the operated leg.

The ice cubes were used for the sensory block evaluation (onset and offset) and the sensor block reversal time. Pain severity was reported during skin incision and 60 min postoperatively by visual analog scale.

Hemodynamic parameters were recorded at the start and every 5 min during operation and every 15 min postoperatively for 60 min.

Time-to-readiness for discharge was described as the period beginning at the end of the operation and ending when the patient’s condition was reported with stable vital signs capable of emptying urine, and nausea and pain could be controlled by oral medication.

Sample size estimation and power calculation
The sample size estimates were based on time-to-readiness for discharge. A sample size of 16 per group was estimated to provide 90% power to detect clinically significant 40 min difference at a meaning level of 0.05.

Statistical analysis
The statistical analysis was done using the statistical package for social sciences, version 20.0 (SPSS for Windows, version 17; SPSS Inc., Chicago, Illinois, USA). All data were expressed as means, standard variance, and frequency. Statistical significance was set at $P$ value less than 0.05. Based on an independent $t$ test, correlations between groups are made. The correlations were tested in groups using Fisher’s exact test and $\chi^2$ test.

The following tests were done:

1. $t$ significance independent samples were used when comparing two means.
3. The confidence interval was set at 95% and the agreed error margin was set at 5%. The $P$ value was therefore regarded as meaningful as follows:
   - (a) $P$ value less than 0.05 was considered significant.
   - (b) $P$ value less than 0.001 was considered as highly significant.
   - (c) $P$ value more than 0.05 was considered insignificant.

Results
The results of the present study are presented in the following tables and figures.

Regarding demographic data, no significant difference between the studied groups was found (Table 1).

Regarding the onset of sensory and motor blocks, it was significantly shorter in group A compared with group B, whereas the recovery time for sensory and motor blocks was longer in group B compared with group A (Table 2).

There was a decrease in time for spontaneous urination, increase in time for first analgesic need, and decrease in time to early discharge in group B as compared with group A, which was statistically significant (Table 3).

Pain score was highly significant lower in group B compared with group A after surgery (Tables 4 and 5).

Table 5 shows no statistically significant difference between groups according to hemodynamic data.

There is a significant difference between group A and group B regarding patient satisfaction (Table 6).

Discussion
The purpose of this study is to explore the use of combined SFB with ultrasound guidance in comparison with unilateral spinal anesthesia in surgical anesthesia time (SAT) in group A was described as complete sensory loss with complete motor blockage at 12-level thoracic. SAT was identified in group B as the complete motor block and sensory of the operated leg.

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Discussion
The purpose of this study is to explore the use of combined SFB with ultrasound guidance in comparison with unilateral spinal anesthesia in
Data are represented as mean±SD. *P<0.05, significant.

Montes et al. [7] done Comparison of spinal anesthesia with combined sciatic-femoral nerve block for outpatient knee arthroscopy in his study subjects were equally divided (n=25 each) into spinal and sciatic-femoral groups. Spinal group patients received spinal anesthesia with 7.5 mg of 0.5% hyperbaric bupivacaine. Sciatic-femoral group patients received combined sciatic-femoral nerve blocks using a mixture of 20 mL of lidocaine 2% plus 20 mL of bupivacaine 0.5%. In the present study, the onset of sensory and motor blocks was significantly shorter in unilateral spinal anesthesia compared to femoral and sciatic nerve blocks. Whereas the recovery time for sensory and motor blocks was longer in femoral and sciatic nerve blocks compared to unilateral spinal anesthesia which agreement with Montes et al. Casati et al. [15], compare the intraoperative and postoperative clinical properties of the sciatic nerve block performed with either 0.5% bupivacaine or 0.5% levobupivacaine for orthopedic foot procedures [14,16]. Two previous studies suggested that SFB was effective and safe as spinal anesthesia without urinary retention [17,18]. Another important factor is the discharge of patients who have been exposed to peripheral nerve block with longer periods of action due to pain deprivation due to lower extremity procedures called sensorial and protective reflexes [6].

An earlier study showed that this was a safe and effective procedure for this group of patients [19]. No adverse events were observed in this study after discharge, which according to the literature.
Table 5 Comparison between groups according to hemodynamic data

<table>
<thead>
<tr>
<th>Hemodynamic data</th>
<th>Group A</th>
<th>Group B</th>
<th>t test</th>
<th>P value</th>
</tr>
</thead>
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<tr>
<td>Systolic</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>137.90±17.06</td>
<td>140.00±17.32</td>
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<td>0.117</td>
</tr>
<tr>
<td>Intra</td>
<td>122.03±15.72</td>
<td>123.89±15.96</td>
<td>1.498</td>
<td>0.109</td>
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<tr>
<td>Post</td>
<td>120.17±10.55</td>
<td>122.00±10.71</td>
<td>1.549</td>
<td>0.101</td>
</tr>
<tr>
<td>Diastolic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>84.44±14.02</td>
<td>83.18±13.81</td>
<td>1.311</td>
<td>0.129</td>
</tr>
<tr>
<td>Intra</td>
<td>74.44±14.24</td>
<td>73.33±14.03</td>
<td>1.572</td>
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</tr>
<tr>
<td>Post</td>
<td>69.50±9.36</td>
<td>70.56±9.50</td>
<td>1.568</td>
<td>0.105</td>
</tr>
<tr>
<td>MABP</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>101.02±14.53</td>
<td>102.56±14.75</td>
<td>1.443</td>
<td>0.119</td>
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<tr>
<td>Intra</td>
<td>89.09±14.02</td>
<td>90.44±14.23</td>
<td>1.637</td>
<td>0.100</td>
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<tr>
<td>Post</td>
<td>86.02±9.17</td>
<td>87.33±9.31</td>
<td>1.290</td>
<td>0.132</td>
</tr>
<tr>
<td>Heart rate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>83.87±11.65</td>
<td>82.22±11.42</td>
<td>1.397</td>
<td>0.113</td>
</tr>
<tr>
<td>Intra</td>
<td>69.70±7.19</td>
<td>68.33±7.05</td>
<td>1.285</td>
<td>0.138</td>
</tr>
<tr>
<td>Post</td>
<td>67.66±6.12</td>
<td>66.33±6.00</td>
<td>1.183</td>
<td>0.155</td>
</tr>
</tbody>
</table>

MABP, mean arterial blood pressure. Independent sample t test. P value more than 0.05 (NS).

Table 6 Comparison of patient satisfaction

<table>
<thead>
<tr>
<th>Groups</th>
<th>Parameters</th>
<th>Group A (N=40)</th>
<th>Group B (N=40)</th>
<th>t test</th>
<th>P value</th>
</tr>
</thead>
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<tr>
<td>Excellent</td>
<td>11</td>
<td>22</td>
<td></td>
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<tr>
<td>Good</td>
<td>15</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fair</td>
<td>10</td>
<td>7</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Poor</td>
<td>4</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P value</td>
<td>0.045 *</td>
<td></td>
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</table>

Data are expressed as numbers. *P<0.05, significant.

Conclusion
SFB provided sufficient sensory blockage, duration, patient satisfaction, and postoperative analgesia than the unilateral spinal anesthesia.

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Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

References