Ultrasound-Guided Lumbar Sympathetic Ganglion Blockade Using Shamrock Method: A Prospective Case Series

Dan-Xu Ma, Yun Wang, Meng-Meng Bao, Chen Zhang, Xue-Yang Li, An-Shi Wu, and Yun Yue

ABSTRACT

Background: Lumbar sympathetic ganglion blockade (LSGB) is traditionally performed using x-ray in either the fluoroscopy suite, or CT in the radiology department. This case series evaluated the feasibility of using the’Shamrock method’ to perform LSGB under ultrasound guidance in patients.

Methods: A total of 16 patients with postherpetic neuralgia received a real-time LSGB under the guidance of Shamrock ultrasound for pain management. The blocks were performed using the in-plane needle insertion. Ultrasound visibility of the lumbar paravertebral structures was assessed in real time during the scout scan. Sympathetic block after LSGB was considered successful when changes in ipsilateral skin temperature between preblock and postblock were >2°C.

Results: The lumbar paravertebral region was successfully visualized in all patients with a median ultrasound visibility score of 15 (range, 8-18). The skin temperature of the big toe before LSGB was significantly lower than that 20 minutes after LSGB. Additionally, the changes in skin temperature between preblock and postblock were >2°C in 15 (93.8%) of 16 patients.

Conclusions: Ultrasound-guided LSGB can be reliably accomplished using the Shamrock method.

The dysfunctional sympathetic system was involved in the development of many pain syndromes such as sympathetically mediated pain (SMP), and diabetic neuropathy (1). This has led to the clinical attempts to temporarily or permanently interrupt the sympathetic nervous system (2, 3). To date, the sympathetic blockade is widely used for the treatment of occlusive vascular diseases, cancer pain, complex regional pain syndrome types I and II, post-discectomy syndrome, phantom limb pain, herpes zoster and the early stages of postherpetic neuralgia, etc (2-5). Lumbar sympathetic ganglion blockade (LSGB) is traditionally performed using x-ray in either the fluoroscopy suite or operating room, or CT in the radiology department (4, 6). The classic percutaneous approach to the LSGB involves the insertion of a needle posterior to the anterior border of the vertebral body under fluoroscopy or CT imaging guidance. This method relies on the bony anatomical landmarks, and makes it a challenge to avoid the injuries to adjacent vessels and visceral organs (7, 8). Additionally, CT scan guidance may result in radiation exposure. Considering these disadvantages with the present techniques of LSGB, we think that there is an overwhelming need to explore the best way to perform this technique clinically.

In the recent decade, the use of ultra-
sonography has increased from a diagnostic tool to a highly accurate imaging tool for needle localization for nerve blockade. The advantages of ultrasonography include bedside application, no radiation exposure, real-time visualization of soft tissues and needle tip advancement, and visualization of the spread of injectate. While ultrasound guidance has become common practice for peripheral nerve blockade, the utility of ultrasound to facilitate LSGB has not been well studied. The aim of this case series was to evaluate the feasibility of using the Shamrock method to perform LSGB under ultrasound guidance in patients with postherpetic neuralgia in lower-extremities.

METHODS

This study was approved by the Ethics Committee of Beijing Chaoyang Hospital, Capital Medical University and written informed consent with an explanation of the purpose of this study was obtained from all patients. From September 2014 to October 2015, a total of 16 consecutive patients with postherpetic neuralgia in lower-extremities, who were scheduled to undergo ultrasound-guided (USG) LSGB were enrolled. Patients were excluded if they had a history of allergy to local anesthetic drugs, local skin infection, coagulopathy, spinal deformity, previous spinal surgery, or body mass index (BMI) greater than 35 kg/m². Routine monitoring (electrocardiogram, heart rate, SaO₂, and noninvasive blood pressure) and intravenous access were established. All procedures were performed by Dr. Yun Wang, who has more than 10 years’ experience with ultrasound-guided injections. The patients underwent LSGB 3 times a week for consecutive two weeks in pain clinic. However, in the current study, we only involve the data for the first LSGB in order to investigate the reliability of Shamrock method.

Patients were positioned in the lateral position, with the side to be blocked uppermost and with the hip and knees flexed (Figure 1A) (9, 10). All LSGBs were performed using a Sonosite Turbo (Philips Healthcare, Andover, Massachusetts, USA) ultrasound system and a curved array transducer (C5-2, 5-2 MHz) under strict aseptic precautions. The target vertebral level (L2) for the lumbar sympathetic block was identified by locating the lumbosacral junction (L5-S1 gap) on a paramedian sagittal scan and then counting cranially to locate the lamina and transverse processes of the L2, L3, L4, and L5 vertebrae. As the previous study described before, the scout scan for the Shamrock sonogram was performed with a minor modification (10-12). To obtain the Shamrock sonogram to facilitate the LSGB, the transverse scan was performed with the transducer positioned at the flank just above the transverse process of the L2 vertebrae (Figure 1B). Personal experience revealed that to obtain the complete Shamrock view, sometimes the curve transducer needed to be slid more posterior, or to be slightly tilted to avoid a part of 12th rib, even with some part of it off the skin.

With the transverse scout scan at the flank in view and after local anesthetic (2-3 ml of lidocaine 1%) infiltration to the skin and subcutaneous tissue, a nerve block needle (22-gauge, 15 cm) was inserted at a point 6-8 cm lateral to the midline. The block needle was inserted in-plane so that it could be monitored in real time as it was advanced. Importantly, the color scanning pattern was used to identify the vessels on the sonogram before the needle was inserted and advanced so that the injuries to the vessels could be avoided. The block needle was slowly advanced under ultrasound guidance to the anterolateral aspect of the L2 vertebral body until needle-vertebral body contact was visualized. After negative aspiration, 8 mL of 0.25% ropivacaine was injected slowly and the injectate fluid spread around the space among vertebral body, abdominal aorta (or inferior vena cava), and psoas muscle. The vital signs and possible complications were monitored for an hour in the recovery room. Distribution of the local anesthetic was assessed in real time on the Shamrock sonogram.

Ultrasound visibility of the lumbar paravertebral structures was assessed in real time during the scout scan (13, 14). The visibility of the vertebra, psoas muscle, transverse process of L2 vertebra, erector spinae muscle, quadratus lumborum muscle, inferior vena cava or abdominal aorta was scored for visibility. Ultrasound visibility was rated using a previously described 4-point Likert scale (0, not visible; 1, hardly visible; 2, well visible; 3, very well visible).
Figure 1. Patient Positioning and the Relationship (in-Plane) of the Nerve Block Needle to the Ultrasound Beam.
A. The schematic diagram shows the position of the patient, and how the ultrasound transducer is oriented during the shamrock scout scan; B. Note the relationship (in-plane) of the nerve block needle to the ultrasound beam. A, erector spinae muscle; B, quadratus lumborum muscle; C, psoas muscle; D, abdominal aorta; E, inferior vena cava.

Figure 2. Shamrock Sonogram of Lumbar Paravertebral Structures.
TP, transverse process; IVC, inferior vena cava; VB, vertebral body; ESM, erector spinae muscle; PM, psoas muscle; QLM, quadratus lumborum muscle.

Tatal ultrasound visibility score (UVS, maximum score possible=15) was also determined (13, 14). Before the start of the study, the investigators agreed that a total UVS greater than 10 would be considered good; 5 to 10, average; and less than 5, poor. We used skin temperature changes as an index of sympathetic block. The skin temperature was measured using an infrared thermometer (Youdeli UT301, Shenzhen, China) at the big toe for 20 minutes, at 5-minute intervals. Sympathetic block after LSGB was considered successful when changes in ipsilateral temperature between preblock and postblock were >2°C as the referential standard (15). If the LSGB was considered to be unsuccessful, the data of the patient was excluded from the statistical analysis.

The data were analyzed using the Statistical Package for the Social Sciences (SPSS for Windows, version 15.0; SPSS Inc, Chicago, Illinois, USA). The data are presented as mean (SD) when normally distributed and as median (range) when not normally distributed. Categorical variables are presented as n (%).

RESULTS

Sixteen patients (9 men and 7 women, aged 52.7 ± 9.8 years; weight, 65.2 ± 8.5kg; height, 169.2 ± 7.9 cm) were studied. The lumbar paravertebral region was successfully imaged in all patients (Figure 2). Overall ultrasound visibility of the lumbar paravertebral structures was judged as good with a median UVS of 15 (range, 8-18) (Table). Real-time USG needle insertion to the anterolateral aspect of L2 vertebrae was performed in each patient studied. Local anesthetics spread within the space among the lateral edge of L2 vertebrae, psoas muscle, and abdominal aorta or inferior vena cava. There were no complications related to the technique or to the local anesthetic injections. All blocks regressed uneventfully.

The skin temperature of the big toe gradually increased after the local anesthetic injection around the sympathetic ganglia of L2. The skin temperature of the big toe before LSGB was significantly lower than that 20 minutes after LSGB (32.8±1.4 versus 35.3±1.7°C, P <0.05). Additionally, the changes in skin temperature between preblock and postblock were >2°C in 15 (93.8%) of 16 patients.

DISCUSSION

Sauter and colleagues reported that the ultrasound-guided in-plane lumbar plexus block could be performed through a transverse scan at the flank slightly above the iliac crest (10). Recently, it was recognized as a Shamrock method and an ultrasound standard for lumbar plexus block (9). To obtain the complete Shamrock view, the curve transducer should be placed at
the flank just above the transverse process of the vertebrae. Under the Shamrock sonogram, the paravertebral structures including erector spinae muscle, quadratus lumborum muscle, psoas muscle are described as the three leaves with the transverse process centered as the stem of Shamrock. Notably, both the edge of the vertebral body, and the abdominal aorta (or inferior vena cava) could be clearly visualized under the Shamrock sonogram. Then, the Shamrock view makes it possible to perform the LSGB under the ultrasound guidance since the LSG are located at the anterolateral area of the lumbar vertebral bodies. In the current study, we successfully performed the USG LSGB by using Shamrock method in 16 patients. To the best of our knowledge, this is the first report on the use of real-time USG LSGB in clinical practice based on the Shamrock view.

The LSGB is traditionally performed under the fluoroscopy. The classical three-needle technique and the lateral technique have been widely used in clinical practice (4, 16, 17). In the current study, we used the lateral technique. For the lateral technique, the tip of the needle should be in front, and just lateral to the L2 vertebra where the sympathetic ganglion is located. The paramedian transverse scan through intertransverse space can limit visualization of the great vessels at the anterior area of the vertebral body. In contrast, the lateral technique combined with the real-time Shamrock ultrasound guidance has an overwhelming advantage over the fluoroscopy-guided technique, since the paravertebral structures, the margin of L2 vertebral body, abdominal aorta or inferior vena cava could be clearly visualized under the Shamrock sonogram. The real-time guidance will contribute to the observation for the spread of the injected local anesthetics and avoid the injuries to the great vessels (7). In the current study, LSGB was considered successful when changes in ipsilateral temperature between preblock and postblock were >2°C as the referential standard.

Our results showed that 15 out of 16 patients underwent LSGB were successful.

One of the limitations is that our report is a noncomparative study, and there are limited published data documenting the safety and efficacy of USG LSGB, and future research to establish its safety and potential advantages is warranted. Another limitation is that the current study was performed in patients with low BMI. The ultrasound visibility of paravertebral structures in lean patients might be better than that in obese patients. There might be more difficulties to perform ultrasound-guided LSGB in obese patients. Additionally, the USG LSGB is a complex procedure, and bears a risk of severe to life-threatening complications. Such an ultrasound technique is not to be performed by beginners, but only by experts or by physicians highly trained with ultrasound-guidance.

In conclusion, we have described a technique of performing USG LSGB using the Shamrock method in a cohort of patients. Future research to establish its safety and efficacy compared with traditional fluoroscopy-guided LSGB is warranted.

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### Table. Ultrasound Visualization and Ultrasound Visibility Scores of the Paravertebral Structures

<table>
<thead>
<tr>
<th>Anatomical Structure Visualized</th>
<th>Frequency of Visualization (N=16)</th>
<th>Ultrasound Visibility Score</th>
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<tbody>
<tr>
<td>Erector spinae muscle</td>
<td>16/16 (100)</td>
<td>2 (1-3)</td>
</tr>
<tr>
<td>Psoas muscle</td>
<td>16/16 (100)</td>
<td>3 (1-3)</td>
</tr>
<tr>
<td>Quadratus lumborum muscle</td>
<td>16/16 (100)</td>
<td>3 (1-3)</td>
</tr>
<tr>
<td>L2 vertebral body</td>
<td>16/16 (100)</td>
<td>3 (2-3)</td>
</tr>
<tr>
<td>Transverse process of L2 vertebra</td>
<td>16/16 (100)</td>
<td>3 (2-3)</td>
</tr>
<tr>
<td>Abdominal aorta or inferior vena cava</td>
<td>16/16 (100)</td>
<td>2 (1-3)</td>
</tr>
<tr>
<td>Total UVS</td>
<td>15 (8-18)</td>
<td></td>
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</tbody>
</table>

UVS, ultrasound visibility score.
References


