

# Observation of single spinal anesthesia by 25G needle puncture through a lateral crypt for hip surgery in elderly patients

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## Abstract

**Background:** Lumbar spine hyperosteoecy and ligament calcification are common in the elderly and anesthesia puncture through the conventional approach is difficult in this age group, and repeated puncture can increase the risk of spinal hematoma and nerve injury. This study aimed to observe the feasibility and safety of single spinal anesthesia administered with 25G needle through the lateral crypt for lower-extremity fracture surgery in elderly patients.

**Methods:** The subjects were 60 elderly patients in our hospital (aged 65–80 years; ASA grades I and II) scheduled for lower-extremity fracture surgery (procedure was predicted to last within 2 h) under single spinal anesthesia by different approaches through L<sub>3–4</sub>. They were randomly divided into 2 groups: in the first group, 25G needle was used in a vertical approach (group C, n=30); in the second, 25G needle was passed through the inner edge of the small joints of L<sub>3–4</sub> to the lateral crypt (group L, n=30). After successful completion of the puncture procedure, 2.5 mL of 0.5% hyperbaric ropivacaine was used for spinal anesthesia. We then recorded the puncture times, sensory block level, and adverse reactions (e.g., headache, lumbago, and lower limb pain).

**Results:** No significant differences in onset time, sensory block level and adverse reaction were noted between the 2 groups. The puncture success rate in group L was not significantly higher and the number of attempts per puncture was not significantly less than that in group C (93.3% vs 70%) ( $P = .063$ ). Nerve-root irritation was more frequent in group L than in group C but with no significant difference ( $P > .05$ ).

**Conclusion:** Single spinal anesthesia through the lateral crypt approach is safe and effective for lower-extremity fracture surgery in elderly patients. Thus, this approach is a feasible alternative when the conventional approach fails.

**Abbreviations:** HR= heart rate, SBP= systolic blood pressure.

**Keywords:** 25G needle, elderly, hip surgery, lateral crypt, spinal anesthesia

## 1. Introduction

Given the simple operation of spinal anesthesia, its exact effect and physiological disturbance are mild. In elderly low-extremity fracture surgery, spinal anesthesia is the most commonly used method of anesthesia.<sup>[1]</sup> Lumbar spine hyperosteoecy and ligament calcification are common in the elderly; hence, anesthesia puncture through the conventional approach is difficult in this age group, and repeated puncture can increase the risk of spinal hematoma and nerve injury.<sup>[2]</sup> In present study, an interstitial small articular rim 25G needle was used for lateral

recess puncture under single spinal anesthesia at the L<sub>3–4</sub> level. The results aimed to provide a reference for clinical practice.

## 2. Materials and methods

### 2.1. General Information

The study was approved by the Hospital Ethics Committee (20150725) and signed informed consent forms were obtained from the patients and their families. We selected 82 elderly patients aged 65 years to 80 years with BMI <24 kg/m<sup>2</sup> who underwent elective lower-extremity fracture surgery (ASA I or II) from January 2015 to November 2017 in our hospital. The exclusion criteria were as follows taboo spinal block, severe cardiopulmonary disease, and central nervous system diseases. 60 patients were included in the study. These patients were divided into 2 groups: group C (vertical approach) and group L (lateral crypt approach) by random number.

### 2.2. Anesthesia puncture

Venous access was established in the upper extremities, and the blood pressure (BP), electrocardiogram (ECG), heart rate (HR), and pulse oxygen saturation (SpO<sub>2</sub>) were routinely monitored. Sodium lactate (10 mL/(kg·h)) was infused. Under vertical position, the patients in group C were selected for L<sub>3–4</sub> gap puncture for local infiltration, with vertical spine at the middle of the spine into the subarachnoid space. Meanwhile, group L was punctured as described by Song Court et al.<sup>[3]</sup> Initially, the L<sub>3–4</sub>

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**Table 1**  
The general information of 2 groups of patients.

Groups	Number	M/F (N.)	Age (yrs)	BMI (kg/m <sup>2</sup> )	The time of anesthetic onset (min)
C	30	18/12	73.5±4.3	22.3±5.3	4.7±0.3
L	30	16/14	72.2±5.6	21.6±4.2	5.1±0.6

M/F = male/female, BMI = body mass index.

**Table 2**  
Comparison of anesthesia in 2 groups of patients.

Groups	Number	Success rate [(%)]	Times (n)	Nerve root Irritant symptoms [(%)]
C	30	21 (70.0)	2.8±0.1	3 (10.0)
L	30	28 (93.3) <sup>a</sup>	1.7±0.3 <sup>a</sup>	7 (23.3)

gap along the median side of the spine was opened up to 1.0 to 1.5 cm. With both hands holding the needle with a 2 cm protruding needle tip, the skin was slowly punctured slightly outwardly at 5° to 10° angle. The depth reached up to 3.5 to 5.0 cm. Once bone, which is the facet joint, was reached, the needle tip was slightly tilted to the medial side by about 10° to 15° and then reinserted until a breakthrough of clear cerebrospinal fluid reflux was seen. Upon puncture success, 2.5 mL 0.5% ropivacaine was injected into the subarachnoid space. Repeated puncturing of more than 3 times was considered failure and the procedure was completed by general anesthesia. After successful anesthesia, with the patient supine, oxygen was delivered at 2 L/min by conventional mask. When systolic blood pressure (SBP) <90 mmHg or >30% of baseline value before anesthesia, phenylephrine (25–100 µg) was injected and hydroxyethyl starch (500 mL) was infused. When SBP >160 mmHg or SBP increased by >30% base blood pressure, urapidil (5–10 mg) was injected. When the HR <50 beats/min, atropine (0.5 mg) was injected intravenously; when HR >120 beats/min, esmolol (0.5 mg/kg) was injected intravenously instead.

### 2.3. Observation indicators

Two groups of patients were observed and recorded for the anesthesia onset time, block plane and effect; lower extremity status during puncture; and incidence of postoperative headache, back pain, and adverse reactions.

### 2.4. Statistical analysis

SPSS 13.0 software for statistical analysis. The normal distribution of the measurement data was obtained, and the mean ± standard deviation was obtained. Groups were compared by *t* test, whereas the count data were compared by the Chi-square test. Differences at *P* <.05 were considered statistically significant.

## 3. Results

A total of 60 patients were enrolled to this study. A total of 32 cases underwent hemiarthroplasty and total hip arthroplasty, whereas 28 underwent femoral trochanter internal fixation. No significant differences in gender, age, BMI, and anesthesia onset were noted between the 2 groups (Table 1).

The puncture success rate in group L was not significantly higher and the number of attempts per puncture was not significantly less than that in group C (*P* = .063). The nerve root stimulation symptoms in group L were more than those in group C, but the difference was not statistically significant (Table 2). The 2 groups of patients did not appear after anesthesia back pain, headache, bleeding and other adverse reactions.

## 4. Discussion

The physiological and anatomical features of elderly patients can often lead to spinal paracentesis or difficult or even failed paracentesis. Moreover, most elderly patients are under long-term anticoagulant; thus, repeated puncture can increase bleeding, infection and nerve damage and other risks.

At the lateral recess at the lateral epidural space the L<sub>3-4</sub> side exhibits a wide lower lumbar spinal canal. Under large laminectomy, a gap exists between the superior margins of the posterior superior iliac spine. The surrounding bony mark is obvious, and the positioning is relatively simple. In about 89% of normal L<sub>3-4</sub> gap, the plane dural sac diameter ≥bilateral medial facet joint spacing, and the lateral recess is apparent and shaped like a clover leaf<sup>[4,5]</sup>; this part can be used as a small articular edge. We studied the theoretical and anatomical bases of the feasibility of the spinal anesthesia by roadside recess puncture. When we adjusted the angle of the puncture needle to break through the spinal canal into the spinal subarachnoid space, the puncture success rate was high. In this study, the puncture success rate in group L was not significantly higher and the number of attempts per puncture was not significantly less than that in group C (*P* = .063). In group L, puncture failure occurred in 2 patients mainly due to bone hyperplasia, obvious puncture through bone and unclear facet positioning and required shifting to general anesthesia. Because the lateral recess is near the nerve root foramen, facet joints and posterior spinal medial branch distribution,<sup>[6]</sup> differences in puncture angle can cause discomfort, and access to the nerve root may be achieved through the facet joint area. Adequate local anaesthetic infiltration should be pursued, and the tip should be positioned such that the medial spine is 10° to 15° to change the puncture angle. In our study, radiating pain of the lumbar area and leg during puncture of the lateral recess was observed in the study group. Increased numbness due to nerve-root irritation was observed in the approach group than in the median approach group, but the difference was not significant.

Ligament injury is the main factor affecting the degree and duration of back pain in spinal canal anesthesia.<sup>[5]</sup> In conventional lumbar–hard combined block, given the thick epidural needle and the needle point incision slope, repeated puncture can increase the physical damage to ligaments, cause peripheral tissue edema, result in aseptic inflammation, release pain-causing media and produce or aggravate lumbar pain discomfort after anesthesia.<sup>[9]</sup> 25G spinal anesthesia holds the advantages of high flexibility, easy passing through narrow bone space, low damage to ligaments and surrounding tissues, reduced leakage of cerebrospinal fluid after spinal anesthesia leading to low-pressure headache<sup>[6-8]</sup> and anesthesia operation with high application value and can hence improve the puncture success rate and safety. In this study, single spine anesthesia with a 25G needle was performed. The effect was exact, and the injury was small. Blood vessel damage due to epidural catheterisation can be avoided through this method. No adverse reactions, such as

headache, back pain, and hemorrhage, ensued after anesthesia in the 2 groups. Notably, the 25G needle puncture operation should be gentle. In case of resistance, the needle can be retracted and the angle readjusted for re-entry without rushing.<sup>[10]</sup>

In clinical practice, to avoid the influence of calcified ligaments, we often choose the lateral spinal canal puncture. However, given the differences in puncture angle, this approach often leads to puncture failure; meanwhile, in the lateral recess approach, the facet is used as basis for positioning, the bone markers are clear, positioning is straightforward, the needle angle and fixation direction are defined and hence, the puncture success rate is high.<sup>[3]</sup>

In summary, the fine needle lateral recess single spinal anesthesia that is performed within less than 2 hours in elderly lower-extremity fracture surgery with low injury risk and few neurological complications can be adopted as a routine approach for puncturing difficult patients who require alternative anesthesia.

However, there are still some limitations in this study. First, this study did not conduct ultrasound-guided puncture to make the results more reliable. Second, we should enlarge the sample size of the study.

### Author contributions

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