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A modified approach of combined anterior lumbar plexus block with lateral sacral plexus block in a semi lateral supine position for lower limb fracture patients: a case series

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Abstract Lumbar plexus block (LPB) and sacral plexus block (SPB) are commonly used regional anesthesia techniques for lower limb surgeries. We propose a novel approach combining anterior LPB and lateral SPB in a semi-lateral supine position with a pad under the upper body. This approach minimizes discomfort and pain during position changes, enhances probe manipulation space, and aids in maintaining aseptic conditions throughout the entire operation. In a study involving 9 elderly patients undergoing hip surgery for femoral neck fractures, we used this modified anterior LPB and lateral SPB technique. Prior to the regional anesthesia, patients were sedated with dexmedetomidine, and the lumbar plexus and sacral plexus were localized using dual guidance techinques, including ultrasound and electrical nerve stimulation. This case series demonstrates the effectiveness of the modified approach, significantly minimizing pain and discomfort associated with positional changes, and is a promising modification to the classical approach.

Trial registration number NCT05901415.

Keywords Hip fractures, Frail elderly, Lumbosacral plexus, Regional anesthesia, Nerve block, Method

Introduction

Lumbar plexus block (LPB) and sacral plexus block (SPB) are commonly utilized anesthesia techniques for patients undergoing lower limb surgeries [1–3]. Classical approaches of LPB and SPB require altering patient position to lateral, which inevitably induces discomfort and pain in patients with lower limb fractures. Several modified approaches of LPB and SPB have been developed with the patients in supine position to minimize discomfort and pain in these group patients [4–7]. However, due to their inherent limitation of insufficient operating space, which increases the difficulty of manipulating probe and needle insertion and decreases the maintenance of sterility in the operating field, they have not been widely used in clinical practice. Therefore, we propose a semi-lateral supine position with an upper body pad, which offers abundant procedural space for performing anterior LPB and lateral SPB while minimizing patient discomfort during position changes. Here, we reported 9 cases of patients undergoing hip fracture surgeries using this approach successfully.

Case report

We described 9 cases of ultrasound-guided anterior LPB and lateral SPB performed in a semi-lateral supine position for elderly patients (75–90 years, 58–80 kg, ASA

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grade III) undergoing closed/open reduction and internal fixation for femoral neck fractures. All patients had a body mass index(BMI) of less than 30 with an average BMI of 27 kg/m^2. Details of case series are summarized and presented in Table 1.

All patients were positioned supine upon arrival in the procedure room. Oxygen (3 L/min) was adiministered via nasal cannula, and intravenous access was established. Routine monitoring, including electrocardiography (ECG), non-invasive blood pressure (NIBP) and oxygen saturation (SpO_2), was performed. To provide mild sedation throughout the procedure, dexmedetomidine infusion was given immediately before the regional block, with a loading dose of 1.0 ug/kg in 10 min, followed by a maintenance dose of 0.2–0.7 ug/kg/h until 30 min before the end of surgery. Patients were then positioned into a semi lateral supine position (Fig.1 Panel C) with a small pad placed under the upper body on the surgical side.

Table 1 Case and surgical variables

Variable	Case1	Case2	Case3	Case4	Case5	Case6	Case7	Case8	Case9
Age	86	87	75	79	86	74	81	90	88
Sex	Male	Male	Male	Female	Male	Female	Female	Male	Male
Weight	60 kg	80 kg	58 kg	60 kg	65 kg	54 kg	50 kg	42 kg	68 kg
Body mass index	20.76 kg/m^2	29.38 kg/m^2	21.56 kg/m^2	21.26 kg/m^2	23.88 kg/m^2	24.00 kg/m^2	20.81 kg/m^2	14.53 kg/m^2	27.24 kg/m^2
ASA class	III	III	III	III	III	III	III	III	III
Diagnosis	1. Right intertrochanteric femur fracture	1. Right intertrochanteric femur fracture	1. Left intertrochanteric femur fracture	1. Right subtrochanteric femur fracture	1. Right subtrochanteric femur fracture	1. Right intertrochanteric femur fracture	1. Right intertrochanteric femur fracture	1. Left intertrochanteric femur fracture	1. Right subtrochanteric femur fracture
	2. COPD	2. Hypertension	2. Diabetes	2. Hypertension	2. Hypertension	2. Brain infarction	2. Hypertension	2. Diabetes (diabetic retinopathy)	2. CHD
	3. TIA	3. Atrial fibrillation	3. ANCA-associated vasculitis	3. Diabetes	3. Diabetes	3. CHD (PCI with stenting)	3. Brain infarction	3. Brain infarction	3. Chronic bronchitis
	4. Deep vein thrombosis	4. Sequelae of cerebral hemorrhage	4. Trigeminal neuralgia	4. Premature ventricular contractions	4. Hypertriglyceridemia	4. Hypertension	4. RA	4. Lumbar vertebral compression fracture	4. Anemia
	5. Severe carotid artery stenosis	5. Diabetes	5. Severe osteoporosis	5. Knee osteoarthritis	5. Fatty liver	5. Atrial fibrillation	5. Lumbar spondylisthesis	5. Pneumonia	5. TKA
	6. Colon adenocarcinoma	6. Benign prostatic hyperplasia			6. Benign prostatic hyperplasia	6. Diabetes	6. THA	6. Pleural fluid	
Procedure	Closed fracture reduction and intramedullary nail fixation for right intertrochanteric	Closed fracture reduction and intramedullary nail fixation for right intertrochanteric	Closed fracture reduction and intramedullary nail fixation for left intertrochanteric	Closed fracture reduction and intramedullary nail fixation for right intertrochanteric	Closed fracture reduction and intramedullary nail fixation for right intertrochanteric	Closed fracture reduction and intramedullary nail fixation for right intertrochanteric	Closed fracture reduction and intramedullary nail fixation for right intertrochanteric	Closed fracture reduction and intramedullary nail fixation for left intertrochanteric	Closed fracture reduction and intramedullary nail fixation for right intertrochanteric
Duration of surgery	62 min	66 min	81 min	60 min	50 min	125 min	92 min	103 min	122 min
Estimated blood loss	100mL	100mL	100mL	50mL	100mL	200mL	200mL	100mL	150mL
Add gerenal anesthesia	No	No	No	No	No	No	No	No	No
Inadequate analgesia affects surgery	No	No	No	No	No	No	No	No	No

ASA, American Society of Anesthesiologists; COPD, Chronic Obstructive Pulmonary Disease; TIA, Transient Ischemic Attack; CHD, Coronary Heart Disease; PCI, Percutaneous Coronary Intervention; RA, Rheumatoid Arthritis; THA, Total Hip Arthroplasty; TKA, Total Knee Arthroplasty

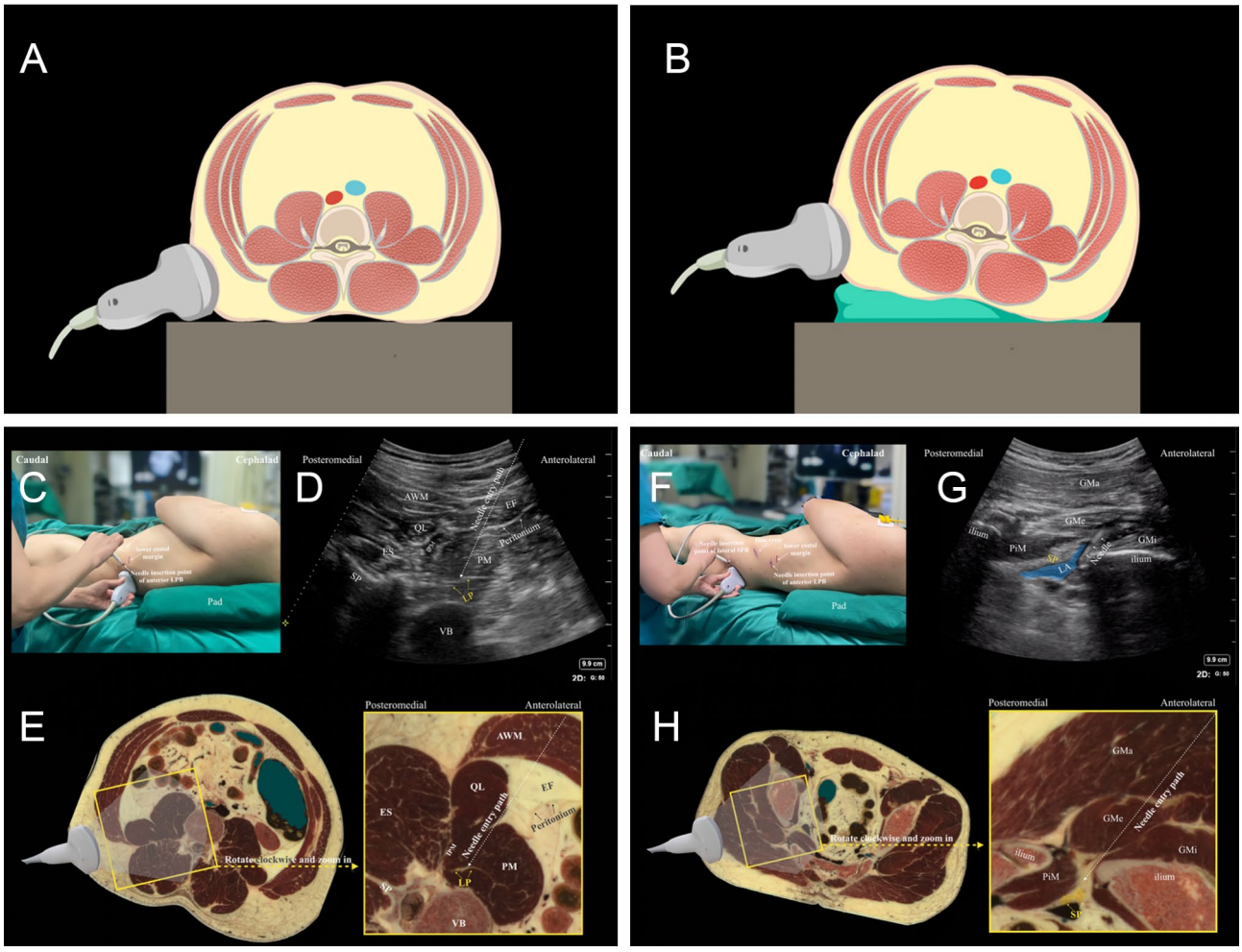

Fig. 1 An anterior-lumbar plexus block and parasacral plexus nerve block in a semi lateral supine posture. Graphic illustration of the supine position **(A)** and semi-supine position **(B)**. **C**. Illustration to indicate probe position of the anterior-lumbar plexus block. **D**. The ultrasound image corresponding to the probe position depicted in **C**. **E**. The sectional anatomy (image courtesy of the VH Dissector) corresponding to the probe position depicted in **C**. **F**. Illustration to indicate probe position of the parasacral plexus nerve block. **G**. The ultrasound image corresponding to the probe position depicted in **F**. **H**. The sectional anatomy (image courtesy of the VH Dissector) corresponding to the probe position depicted in **F**. AWM, abdominal wall muscle; PM: psoas major; SP: spinous process; VB: vertebral body; QL: quadratus lumborum; ES: erector spinae; ITM: intertransverse muscle; EF: extraperitoneal fat; GMa: gluteus maximus muscle; GMe: gluteus medius muscle; GMi: gluteus minimus muscle; SP: sacral plexus; PiM: piriform muscle;

Firstly, a convex array probe (SonoSite, USA) was placed transversely under the lower edge of the 12th rib, with its anterior end on the midaxillary line. The probe was moved caudally untill the classical Shamrock sign, first described by Sauter [8], was identified at the L3 vertebra with peritoneum, extraperitoneal fat, and three layers of abdominal wall muscle were seen on the superficial aspect of quadratus lumborum (Fig.1 Panel D). The transducer was then pressed and tilted caudally to ensure that no intestines were in the puncture trajectory. To further mitigate the risk of vascular puncture, the use of color Doppler mode is recommended to visualize and avoid nearby vessels during needle advancement. This additional precaution can enhance the safety and precision of the block. After sterilization, an echogenic needle (SonoPlex®STIM) with stimulation techniques was advanced in-plane from the anterolateral end of the probe, sequentially passing through the three layers of abdominal wall muscles, extraperitoneal fat, and the psoas major muscle until the needle tip rested right next to the hyperechoic lumbar plexus (LP) visualized deep within the psoas major muscle(Fig.1 Panel E). A 0.5-1.0 mA current with a 0.1 ms impulse duration and 2 Hz frequency nerve stimulation was applied to confirm the precise location of the LP, indicated by quadriceps femoris twitches. After a negative blood aspiration test, 15–20 mL of 0.375% ropivacaine was administered, and its spread around the LP within the psoas muscle was visualized. Following that, the probe was placed along the line connecting the greater trochanter and the posterior superior iliac spine, then slid parallel to the line caudally until the hyperechoic line of the iliac wing was

Table 2 Pain scores and analgesia requirements

Variable	Case1	Case2	Case3	Case4	Case5	Case6	Case7	Case8	Case9
VAS score									
At rest	3	3	3	3	3	2	3	3	2
Preblock	3	3	3	4	3	2	3	3	2
Immediate postioning	3	3	4	4	3	2	3	3	2
Postblock	2	1	2	1	2	1	1	1	2
During surgery	1.3	1.9	2.8	3	3.6	1.9	1.1	1.6	1.1
Postoperative 2 h	1	2	1	1	1	1	1	1	1
Postoperative 6 h	1	1	1	1	2	1	1	1	1
Postoperative 24 h	1	1	2	1	2	1	1	2	1
Postoperative 48 h	2	2	1	2	1	1	1	1	2
Analgesia requirement during surgery	No	No	No	No	No	No	No	No	No

VAS score, Visual Analog Scale score;

interrupted and the ischial foramen appeared(Fig.1 Panel F). The sacral plexus (SP) was identified posterior to the lateral border of the ischial foramen and deep to the piriformis muscle(Fig.1 Panel H). Then the needle was introduced in-plane from the anterolateral side of the probe and advanced posteromedially towards the SP, which was also confirmed via electrical nerve stimulation (0.5-1.0 mA, 0.1 ms impulse duration and 2 Hz frequency) with contractions of the gluteal muscles or the lower limb muscles. After a negative blood aspiration test, 10–15 mL of 0.375% ropivacaine was administered and its spread around the SP was visualized(Fig.1 Panel G). Practitioners need to be proficient in both nerve stimulation and ultrasound to ensure successful LPB and SPB. During the surgery, a low dose(up to1.0 ~ 1.5 ug/ml) of propofol was administered using a target-controlled infusion (TCI) model if the patients felt uncomfortable, targeting the plasma concentration. Postoperative follow-up indicated that all patients reported satisfactory pain control throughout the surgical procedure. Table 2 summarizes the patient's VAS scores at different times and their analgesia requirements.

Discussion

In this report, the average age of patients with hip fractures was 82.9 years. These patients showed frailty in various organs due to aging and associated complications, which are often accompanied by multiple comorbidities. Physiological degenerative changes and preexisting diseases heighten the perioperative risks for elderly patients [9]. While regional anesthesia offers potential advantages such as relatively stable hemodynamic and a lower incidence of respiratory infections [10, 11], some studies suggest that there is no significant difference in mortality rates and postoperative delirium between regional anesthesia and general anesthesia [12, 13]. De Visme et al. demonstrated that combined lumbar and sacral plexus block provides better hemodynamic control compared with spinal anesthesia [14]. In this case series, we reported three patients with respiratory diseases (COPD, pneumonia, and chronic bronchitis) who were at a high risk of postoperative complications, such as respiratory infection and even respiratory failure, if undergoing general anesthesia [15]. Additionally, we reported a patient with a lumbar vertebral compression fracture, where performing spinal or epidural punctures would be challenging. Moreover, two patients with atrial fibrillation were undergoing anti-coagulant therapy, which is a relative contraindication for central neuraxial blocks. We believe the currently introduced block technique could provide more benefits to these specific groups of patients.

With the current semi lateral-supine posture technique, we successfully implemented anterior LPB and lateral SPB for patents with hip fractures, minimizing the pain and discomfort associated with positional changes. So far, several supine peripheral nerve block techniques have been promoted to avoid discomfort and pain caused by positional changes for patients undergoing hip fracture surgery. The fascia iliaca compartment block (FICB) is regarded as an anterior LPB technique and is often used in patients undergoing hip fracture surgery without any positional alteration [16]. However, owing to the lower reliability of the obturator nerve block, FICB can not completely replace LPB [17]. Different LPB approaches in supine position have been previously developed. Liu [4] reported an lateral LPB in supine position(Fig.1 Panel A) with a sagittal scanning and in-plane approach, in which the probe was placed at the posterior axillary between the costal margin and iliac crest. Likewise, Yang [7]employed a short-axis scanning and out-plane approach to conduct LPB on supine patients by placing the probe at the costal margin and iliac crest proximal to the midaxillary axillary line. Similarly, Saranteas [5] described LPB procedures on supine patients using an in-plane approach and short-axis scanning, with the probe placed on the flank just cranial to the iliac crest. Although these supine

LPB methods avoid pain caused by positional changes, they have and inherent limitation: the probe must be positioned on the ventrolateral or ventrolateral posterior wall. However, due to the proximity of the probe to the bed surface, the operating space for the probe is limited, making it difficult to obtain high-quality imaging of LP and puncture needles. Moreover, the risk of contamination in the operating field also increases. The lateral SPB approach proposed by Wang on supine patients is also subject to similar drawbacks [6]. Hence, we propose a modified approach involving a semi-lateral supine position, requiring patients to slightly rotate their upper body and stabilize the position with a strategic positional pad (Fig.1 Panel B). This approach provides sufficient space for disinfection and probe manipulation, facilitating the block procedure and minimizing patient discomfort associated with positional changes. A limitation of this investigation is the relatively small sample size. Potential risks of this procedure include unintentional peritoneal perforation and visceral injury, which can be effectively mitigated via a maneuver of pressing and slightly tilting the transducer caudally. Additionally, A Color Doppler should be recommended to visualize the blood vessels and thereby reduce the risk of vascular puncture. Based on our cases, this approach appears suitable for the majority of patients, though its application in extremely thin or obese patients has not been fully validated. It may not suitable for underweight patients due to their thin subcutaneous fat and extraperitoneal fat, which make the needle pathway highly prone to piercing the peritoneum and potentially causing injury to organs such as the liver and kidney. It may also unsuitable for excessively obese patients as the length of the needle may not be adequate to reach the vicinity of the LP and SP, resulting in inadequate or failure nerve block. We are currently conducting a randomized trail to investigate the pain scores, block procedure duration, anesthetic requirements, and complications for the various positions, to futher validate the feasibility, efficacy, and safety of our newly developed approach.

In conclusion, this case series reports the successful application of combined anterior LPB and lateral SPB in a semi-lateral supine position for hip fracture surgery. This approach minimizes the pain and discomfort arising from patient repositioning while ensuring adequate sterilization and maneuvering space for the probe. It is suitable for elderly patients who are not suitable for general or spinal anesthesia. In this case series, a semi-lateral supine position with a pad was observed to provide advantages for both patients and operators. We believe this method is valuable for patients who can benefit from peripheral regional anesthesia, including those with lower limb fractures and patients requiring surgery with a traction frame.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12871-025-02943-0 .

Supplementary Material 1

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Not applicable.

Author contributions
Data collection and analysis were conducted by Heyu Ji, and Xulei Cui; Manuscript preparation was conducted by Heyu Ji; Manuscript review and correction were conducted Xulei Cui.

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Data availability
All data generated or analyzed during this study are included in this published article and its supplementary information files.

Declarations

Ethics approval and consent to participate
This investigation received ethical approval from the Institutional Review Board of Peking Union Medical College Hospital (I-23PJ249), and all participants signed a written consent form. Consent obtained directly from patients.

Consent for publication
Informed consent was taken by patients for publication.

Competing interests
The authors declare no competing interests.

Conflict of interest
None declared.

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