

Ultrasound-guided psoas compartment block using the intertransverse ligament as a tactile endpoint: a technical refinement – a case series of 25 patients

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Research Article

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Abstract

Background

Conventional psoas compartment block (PCB) relies on indirect soft-tissue landmarks, lacking a definitive tactile endpoint, which may lead to variable success and a steep learning curve. We describe a technical refinement that uses the lumbar intertransverse ligament (ITL)—a constant, sonographically distinct structure—as a definitive tactile endpoint for ultrasound-guided PCB.

Case presentation

Twenty-five consecutive adult patients undergoing unilateral hip or femoral surgery received the refined block. Using an out-of-plane approach with hydrodissection to confirm needle tip placement, 25–30 mL of 0.35% ropivacaine was injected at the L1–L2 and L2–L3 levels. Technical success (characteristic crescent-shaped injectate spread) was achieved in all patients. At 15 min post-block, 23 patients (92%) had complete sensory blockade in the femoral, lateral femoral cutaneous, and obturator nerve territories; by 30 min, this reached 100%. Mean onset time was 18.4 min. One patient experienced transient quadriceps weakness that resolved completely within 33 h; no other complications occurred.

Conclusions

The refined PCB using the ITL as a tactile endpoint is feasible, safe, and reproducible. Its dual sonographic and tactile feedback may enhance procedural standardization and teachability, offering a practical educational tool for regional anesthesia training.

Background

Psoas compartment block (PCB) is a well-established technique for providing analgesia to the hip and thigh. It is typically performed using landmark guidance or ultrasound, with the needle endpoint identified by a “pop” through the psoas fascia or fascial “shimmer” – all indirect and largely subjective [1,2]. This subjectivity can lead to inconsistent local anesthetic spread and a prolonged learning curve.

The lumbar intertransverse ligament (ITL) is a constant, hyperechoic structure connecting adjacent transverse processes, lying superficial (posterior) to the target psoas compartment plane [3]. Anatomical studies have confirmed a potential space between the ITL and the psoas major that communicates with the lumbar plexus territory [4,5]. We therefore refined the conventional PCB by deliberately penetrating the ITL as a definitive tactile endpoint. This report describes the technique and its preliminary application in 25 consecutive patients.

Case presentation

Ethics and consent

The study was approved by the Ethics Committee of Beijing Jishuitan Hospital Guizhou Hospital (approval number KT20250713010) for the project “Comparative study on the effects of regional anesthesia and general anesthesia on the reticular activating system (RAS) function in elderly patients with hip fracture: a mechanism exploration based on blood pressure variability and norepinephrine”. The present technical report describes a refined regional anesthesia technique that is part of this approved project. Written informed consent was obtained from all participants.

Patient population

Twenty-five consecutive adult patients (14 men, 11 women) scheduled for unilateral hip or femoral surgery were enrolled. Their mean (SD) age was 58.2 (12.5) years, and mean body mass index was 24.1 (3.2) kg·m⁻². Exclusion criteria were infection at the puncture site, coagulation disorders, allergy to local anesthetics, severe spinal deformity, and patient refusal.

Block technique

With the patient in the lateral decubitus position (non-operative side down), a low-frequency convex transducer (2–5 MHz) was placed in a paramedian sagittal plane 3–4 cm lateral to the posterior midline. By sliding the probe, the tips of adjacent L1–L3 transverse processes were identified. Fine adjustments revealed the thin, linear hyperechoic ITL connecting them (e.g., L1–L2 and L2–L3) (Fig. 1A). Deep to the ITL, the hypoechoic posterior fascial border of the psoas major marked the target plane.

An out-of-plane (OOP) approach was used. After local infiltration, a 22G, 100-mm needle was advanced toward the probe at a 30°–45° angle. Needle-tip identification was achieved by subtle “to-and-fro” movements, which induced a hyperechoic dot. When this dot contacted the ITL, a subtle increase in resistance was felt; further advancement produced a distinct loss-of-resistance (“pop”) as the tip passed into the hypoechoic plane deep to the ligament (Fig. 1B).

To confirm correct placement, hydrodissection was performed: 0.5–1.0 mL of normal saline was injected. A small anechoic fluid collection separating the ITL from the psoas major confirmed the correct plane; resistance or globular collection indicated repositioning. After negative aspiration, 10–15 mL of 0.35% ropivacaine was injected at the L2–L3 level. The probe was then shifted cranially, and without withdrawing the needle, the tip was redirected to the L1–L2 level for a second injection of equal volume (total 25–30 mL). Real-time ultrasonography showed injectate lifting the ITL anteriorly and spreading in a characteristic crescent-shaped pattern (Fig. 1C).

Outcome assessment

Outcome assessment

Sensory blockade was assessed by pinprick at 15 and 30 min after injection in the territories of the femoral nerve (mid-anterior thigh), lateral femoral cutaneous nerve (mid-lateral thigh), and obturator nerve (mid-medial thigh). Blockade was defined as diminished or absent sensation. Onset time was defined as the interval from completion of injection to complete sensory blockade in all three territories.

Results

Technical success (characteristic crescent-shaped spread) was achieved in all 25 patients. At 15 min, 23 patients (92%) had complete blockade in all three nerve territories; the remaining two had partial obturator blockade that became complete by 30 min. Mean onset time was 18.4 (SD 5.2) min.

Intraoperative analgesia was satisfactory; only one patient whose surgical incision extended to the posterior thigh required intravenous opioids. No other patient required supplemental opioids. At 24-h follow-up, two patients reported mild, transient low back discomfort, which resolved spontaneously. One patient experienced transient quadriceps weakness that recovered completely within 33 h. No hematoma, infection, persistent neurologic deficits, or local anesthetic systemic toxicity occurred.

Additional observations

Two patients with higher body mass index (28.7 and 29.4 kg·m⁻²) required 20–25 min for complete obturator blockade [6]. One lean patient (BMI 19.1 kg·m⁻²) reported immediate pain relief upon injection. Five patients described a transient dull “pressure” at the moment of ligament penetration, resolving within seconds without sequelae. These observations are further discussed below.

Discussion and conclusions

This case series describes a technical refinement of the conventional psoas compartment block by using the ITL as a definitive tactile endpoint. While traditional ultrasound-guided PCB relies on subjective soft-tissue identification, our approach provides a fixed, sonographically distinct target that yields a clear loss-of-resistance upon penetration – analogous to the feedback of an epidural needle [7]. This dual feedback may reduce operator dependence on perfect image quality and facilitate teaching, especially for trainees.

Anterior quadratus lumborum block relies on observing the “shimmer” of the quadratus lumborum fascia [8], while posterior lumbar plexus block targets a “pop” through the psoas fascia. Both are valid but inherently subjective. Our refined block, by contrast, uses a structure that is physically penetrated, providing objective confirmation. This may translate to more consistent local anesthetic spread, as evidenced by the uniform crescent-shaped pattern we observed in all 25 patients.

A recent cadaveric study by Diwan et al. demonstrated that the fascial planes hosting the lumbar plexus nerves – the psoas plane, circum-psoas plane, and fascia iliaca plane – are distinct entities with no communication between them [9]. This finding underscores the importance of precise needle placement. By using the ITL as a portal, our technique consistently accesses the correct plane, improving reliability.

The observed sensory blockade – reliably involving the femoral, lateral femoral cutaneous, and obturator nerves – mirrors that of a successful PCB. We postulate two synergistic mechanisms: (1) direct interfascial spread within the ITL-psoas plane, bathing branches of the lumbar plexus as they emerge from the lateral border of the psoas major [5]; and (2) deep penetration within the psoas muscle, affecting nerve trunks that course within the muscle. Diwan et al. showed that injections in the psoas plane consistently stain the femoral and lateral femoral cutaneous nerves [9], supporting the first mechanism. Although they found no communication between the psoas plane and the paravertebral space [9], their observation that psoas plane injections stain the obturator nerve in all specimens suggests that the medial spread required for obturator blockade occurs within the psoas itself – consistent with the second mechanism.

The delayed obturator blockade in two patients with higher BMI aligns with anatomical studies showing that the obturator nerve lies deep within the psoas and requires direct deposition in the correct plane [6,9]. Such inter-individual variability suggests that injectate volume may need individualization – a hypothesis for future study.

The transient quadriceps weakness seen in one patient confirms a temporary motor effect; its complete recovery supports safety. Importantly, Diwan et al. reported no intraneural, intervertebral foraminal, or epidural spread of latex [9], reinforcing the safety of this deep block. According to the latest American Society of Regional Anesthesia (ASRA) guidelines, both conventional PCB and our refined technique are classified as deep blocks where external compression cannot achieve haemostasis; however, the use of a definitive tactile endpoint may reduce the risk of misplaced injections.

Limitations

This is a descriptive case series with a modest sample size and no control group. We did not perform motor block assessment for the obturator nerve; future studies should include detailed sensory mapping or nerve stimulation to confirm complete blockade. The spread pathways are inferred from ultrasound and literature, lacking direct imaging evidence (e.g., contrast-enhanced CT or cadaveric dye studies).

Conclusions

The refined psoas compartment block using the ITL as a tactile endpoint is a feasible, safe, and reproducible technical improvement. Its dual feedback may enhance procedural standardization and teachability. This report provides a foundation for future comparative studies and educational initiatives in regional anesthesia.

Declarations

Ethics approval and consent to participate

The study was approved by the Ethics Committee of Beijing Jishuitan Hospital Guizhou Hospital (approval number KT20250713010) for the project “Comparative study on the effects of regional anesthesia and general anesthesia on the reticular activating system (RAS) function in elderly patients with hip fracture: a mechanism exploration based on blood pressure variability and norepinephrine”. Written informed consent was obtained from all participants.

Consent for publication

Written informed consent for publication of anonymized clinical details and ultrasound images was obtained from all patients. A copy of the consent form is available for review by the Editor.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

MX (Meng Xiance): study conception, design, data acquisition, drafting; WD (Wang Deli): data acquisition, analysis, revision; HG (Huang Guihua): supervision, revision, funding, guarantor. All authors read and approved the final manuscript.

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Authors' information

Not applicable.

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Figures

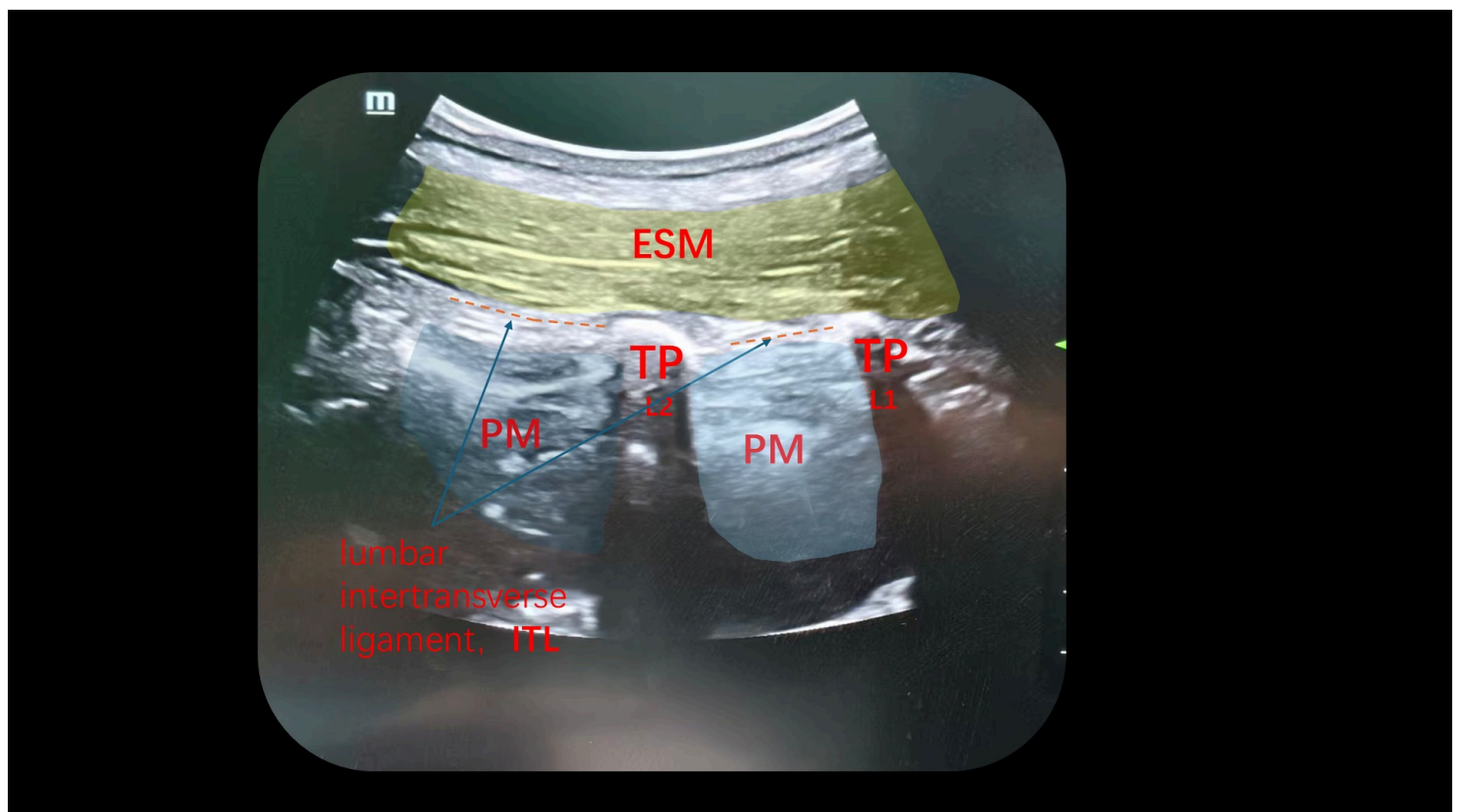


Figure 1

Fig. 1A:Paramedian sagittal ultrasound image showing the tips of L1 and L2 transverse processes (TP) and the linear hyperechoic intertransverse ligament (ITL, arrow) connecting them. PM, psoas major muscle.

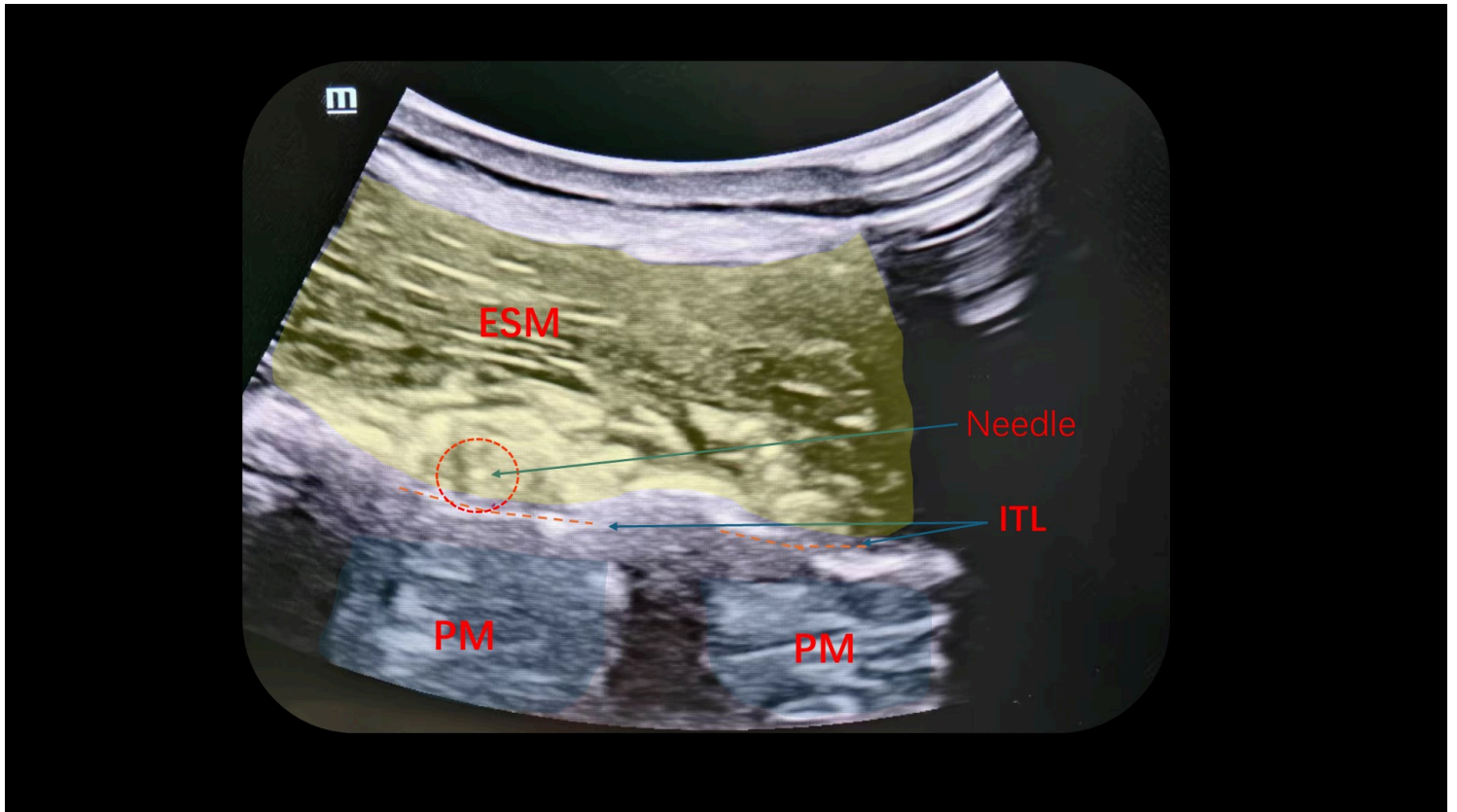


Figure 2

Fig. 1B:Ultrasound image during needle (N) advancement. The needle tip (arrowhead) is visualized penetrating the hyperechoic ITL (arrow).

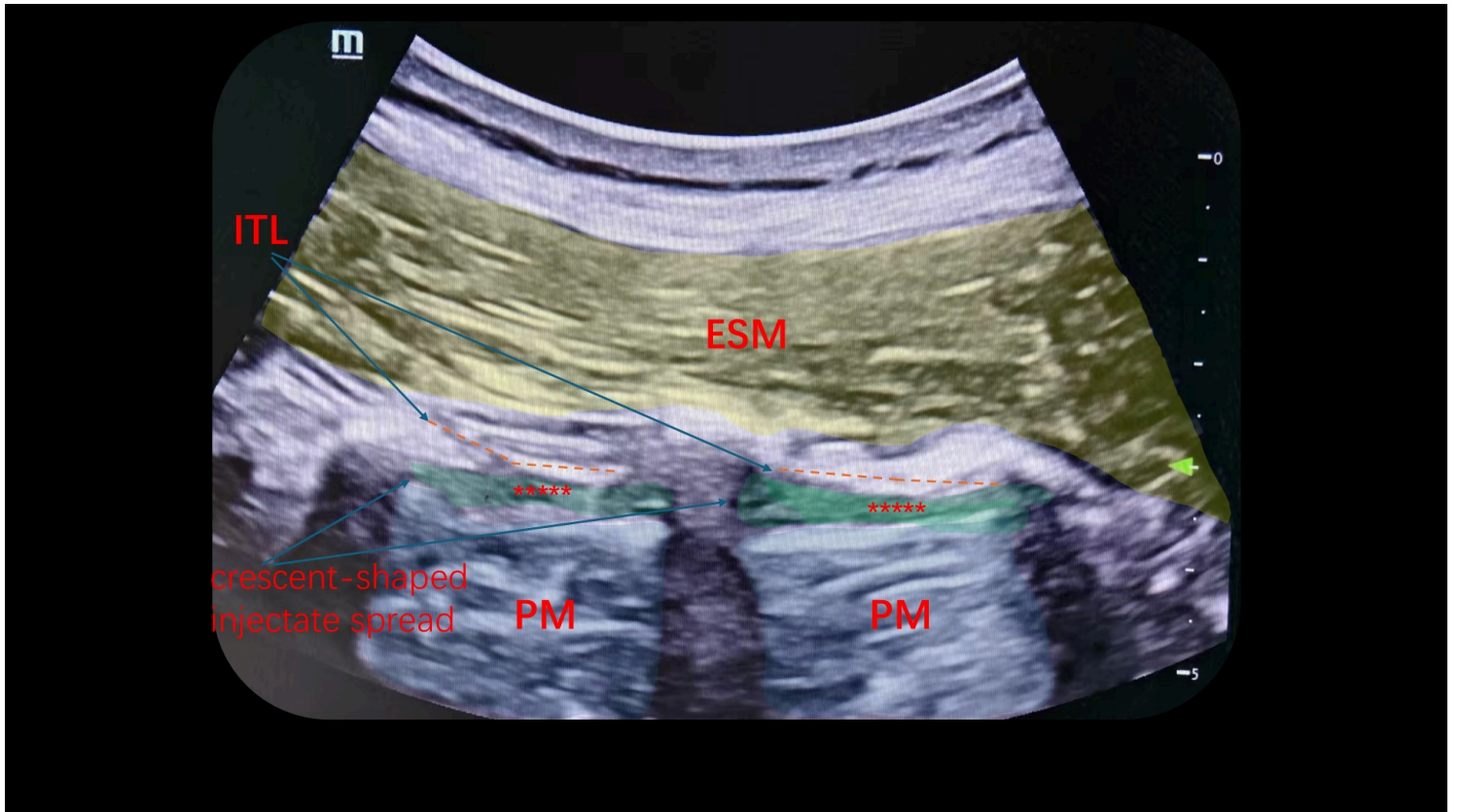


Figure 3

Fig. 1C: Post-injection image showing crescent-shaped anechoic injectate spread (*) between the ITL (arrow) and the PM.