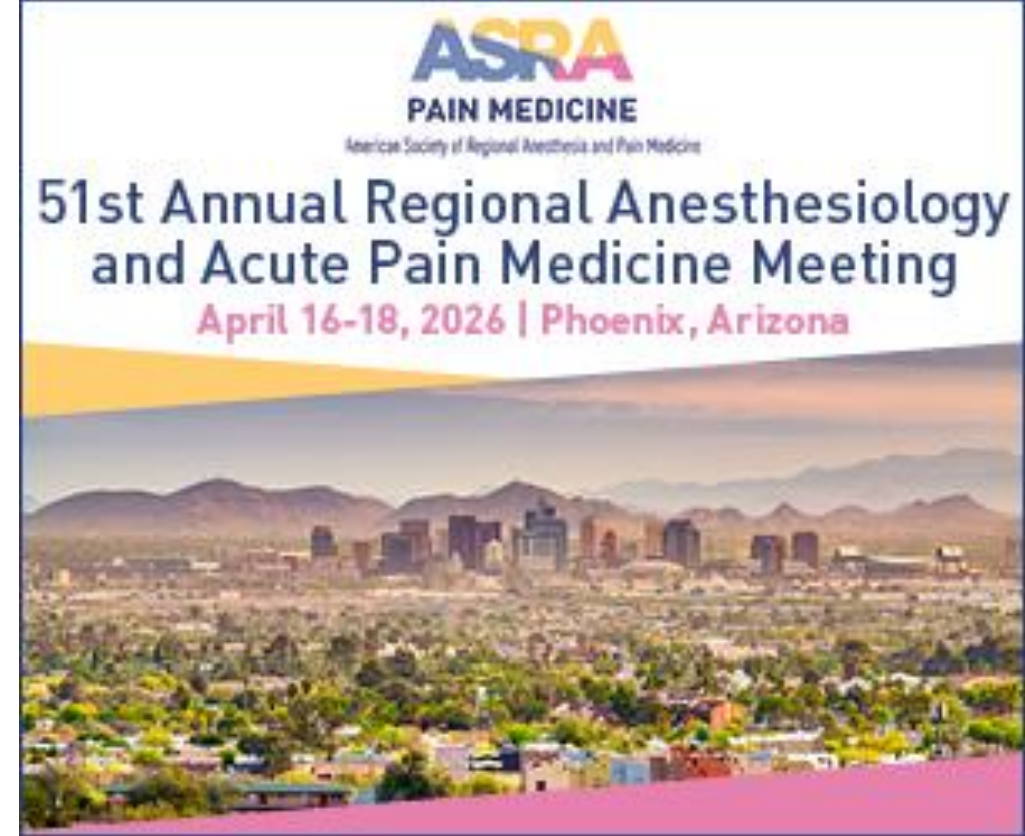


Anterior Inferior Psoas Injection for Lumbar Plexus Coverage: A Follow-Up Cadaver Dye Study

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Introduction

Regional anesthesia for hip surgery remains challenging, as commonly used anterior techniques provide incomplete coverage of the Femoral Nerve (FN), Lateral Femoral Cutaneous Nerve (LFCN), and Obturator Nerve (ON). The Fascia Iliaca Compartment Block excludes the ON, while the Peri-capsular Nerve Group block misses the LFCN. Lumbar plexus blocks offer broader coverage but have added risks. This follow-up cadaveric dye study evaluates the reproducibility of an anterior inferior psoas single injection targeting all three nerves. We hypothesized that this approach would produce reproducible cranial lumbar plexus-adjacent fascial spread with multi-branch neural involvement.

Materials & Methods

This study conducted on two GreenMBalmed cadavers (three hips) through University of North Carolina body donation program. The study was IRB exempt with appropriate institutional permissions obtained.

- Injections supine position using 10-3 MHz curvilinear ultrasound probe to obtain a parasagittal long-axis view of psoas major muscle. A 100 mm, 21-gauge echogenic needle was advanced to posterior epimysium of the psoas major muscle and 30 mL of 0.1% methylene blue dye was injected in a caudal-to-cranial trajectory (**Figures 1 – 3**).
- Cadavers positioned prone for standardized layered dissection. Dye spread was assessed to evaluate spread to LFCN, FN, and ON.
- Neural staining was categorized qualitatively as robust, partial, or absent.

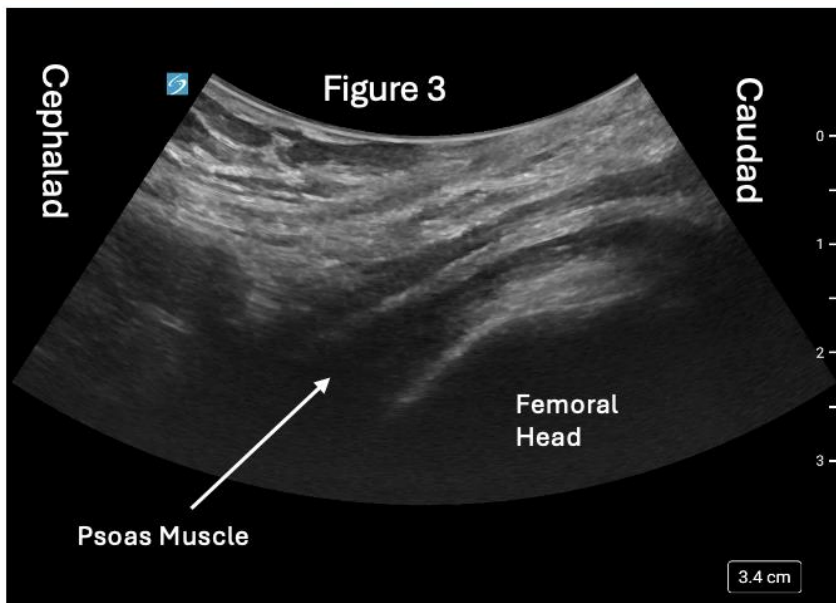
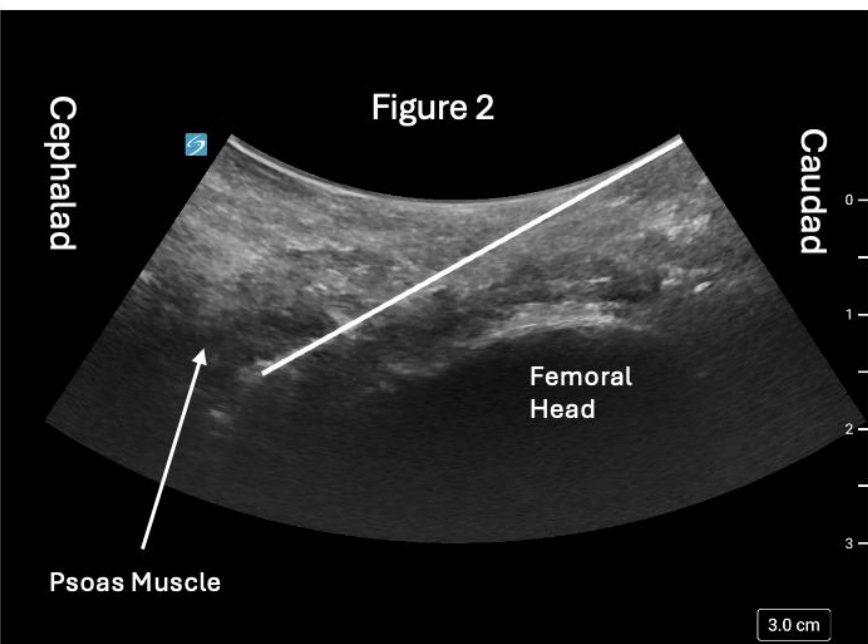
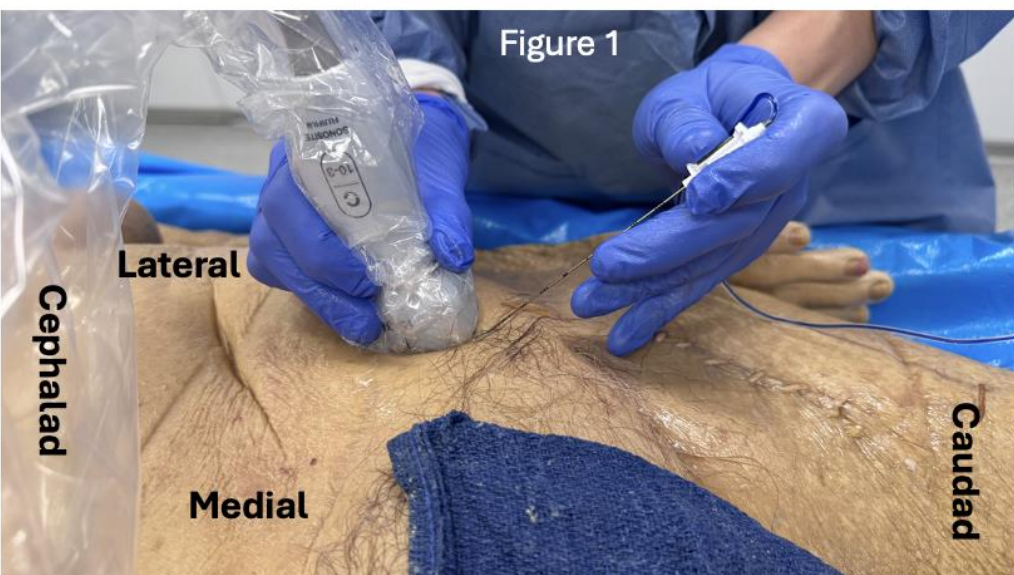


Figure 1: Injection of dye caudal to cephalad direction on cadaver hip.

Figure 2: Long axis view of iliacus and psoas muscles outlining trajectory.

Figure 3: Dye injected into posterior epimysium of Psoas Major muscle with injection intended to go proximally

Results

In all 3 cadaver hips, dye tracked anterior to the quadratus lumborum (QL) muscle with dense staining of the fascia transversalis and middle layer of the thoracolumbar fascia, extending cephalad to the level of the 12th rib.

Neuronal involvement demonstrated a reproducible pattern similar to the prior dye study with staining of all three nerves of interest (ON, FN, and LFCN), but with variability in degree. The LFCN and iliohypogastric nerves were consistently stained across specimens (**Figures 5 and 6**). Partial staining of the FN was observed in most cadavers, predominantly along the posterior or fascial surface rather than circumferentially (**Figure 6**). The ON was stained in two of the three specimens, suggesting variable medial lumbar plexus penetration (**Figure 7**).

Detailed neural and fascial staining patterns are summarized in **Table 1**.

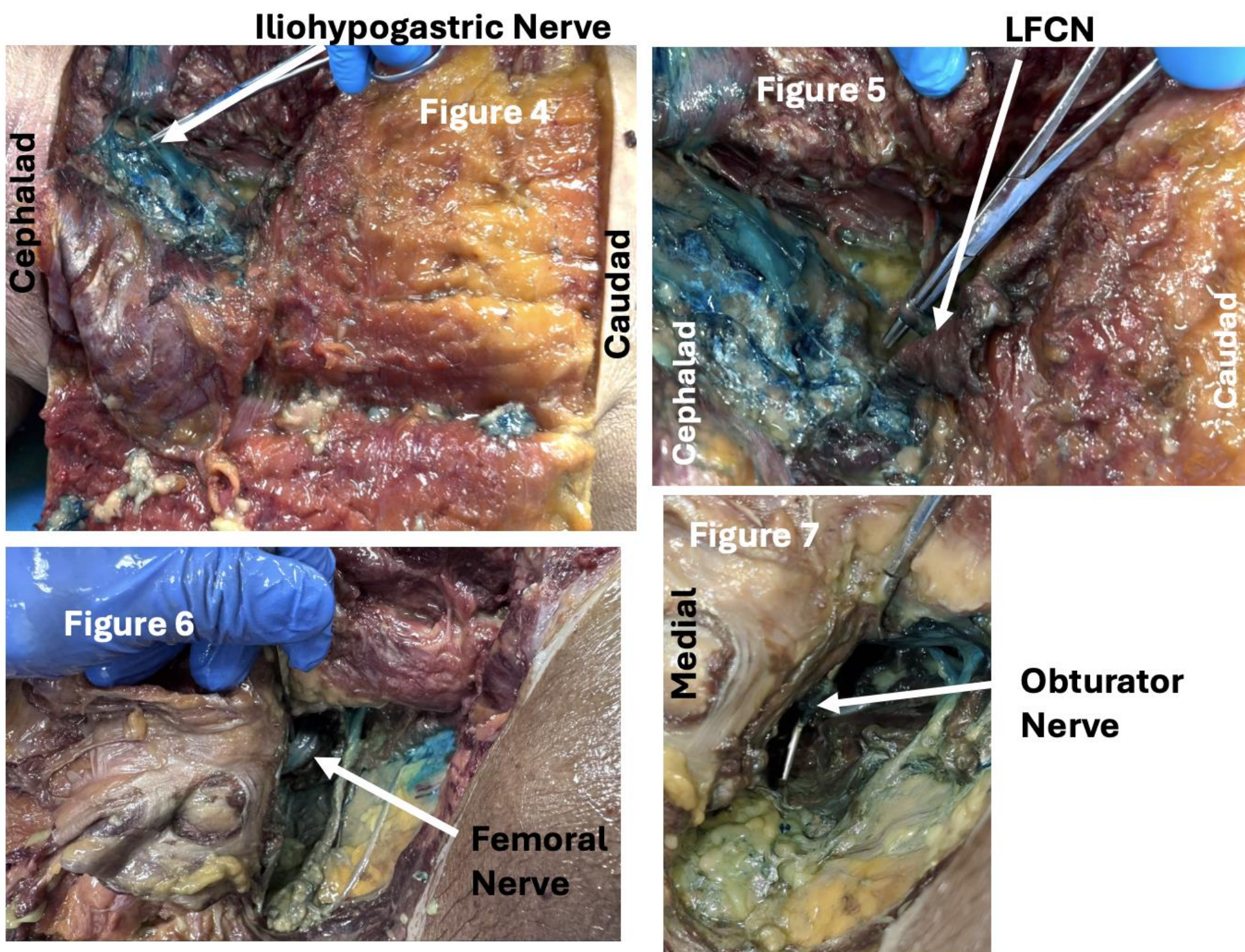


Figure 4: Staining of anterior surface of quadratum lumborum muscle with staining of iliohypogastric nerve shown.

Figure 5: Lateral Femoral Cutaneous Nerve (LFCN) staining at lateral aspect.

Figure 6: Femoral nerve staining.

Figure 7: Obturator Nerve staining.

Table 1: Neural and Fascial Staining Patterns Following Anterior Inferior Psoas Injection

Structure	Cadaver 1	Cadaver 2	Cadaver 3	Consistency across specimens
LFCN	Robust	Robust	Robust	High
Iliohypogastric	Robust	Robust	Robust	High
Femoral Nerve	Partial (posterior)	Partial	Minimal	Moderate
Obturator Nerve	Present	Present	Absent	Variable
Thoracolumbar Fascia	Dense	Dense	Dense	High
Perinephric Region	Dense	Dense	Dense	High
Psoas Muscle Belly	Minimal	Minimal	Minimal	Consistent Pattern

Conclusions

This follow-up cadaveric dye study demonstrates a reproducible anterior approach capable of staining LFCN, FN, and ON via a single injection and supports its potential use as a lumbar plexus-adjacent technique. Although this study found consistent staining of the lateral lumbar plexus branches, producing reliable coverage of the LFCN, it found variable FN and ON involvement, suggesting a potential limitation in penetration. Further cadaveric and clinical studies are needed to evaluate this pattern and clinical efficacy. Limitations include small sample size and cadaveric modeling without physiologic tissue pressure, which may influence fascial spread patterns.

At a Glance

Study Question:

- Does a single injection at the anterior inferior psoas reach the LFCN, FN, and ON?

Model:

- 2 cadavers, three hips; methylene blue 0.1%, 30 mL.

Key Findings:

- An anterior approach using the single injection anterior inferior psoas injection technique can reproducibly provide coverage of the LFCN, FN, and ON.

Potential Clinical Applications:

- The anterior inferior psoas injection technique is a potentially safer alternative and can provide similar coverage to the lumbar plexus block using an anterior supine approach.

Next Steps:

- Prospective clinical trials evaluating analgesic efficacy, opioid use, and functional outcome in patients undergoing hip surgery.

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