

Ultrasound Guided Suprainguinal Fascia Iliaca (SIFI) Nerve Block For Total Hip Arthroplasty

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INTRODUCTION:

Different regional anesthesia techniques have been implemented to decrease postoperative pain following total hip arthroplasty (THA), all with varying success^{1,2}. The fascia iliaca block is used to block the lateral femoral cutaneous nerve (LFCN), but has a reported 10-37% failure rate³⁻⁵. The LFCN is traditionally blocked below the inguinal ligament by both regional anesthesiologists and chronic pain specialists or damaged below the inguinal ligament by surgeons attempting anterior approaches in hip surgery^{6,7}. Below the inguinal ligament, the LFCN has a variable course of distribution and branching (figure 1). Above the inguinal ligament, however, the LFCN has a reliable course immediately below the fascia iliaca in the pelvis⁸. Hebbard, *et al.* described an approach in both patients cadavers by injecting above the inguinal ligament to achieve LFCN coverage⁹. Despite the advantages of the suprainguinal approach, the long needle path and the body mass of North American patients can make this approach challenging. We hypothesize that an ultrasound guided out-of-plane suprainguinal fascia iliaca (SIFI) block would be simpler to perform and provide successful postoperative cutaneous analgesia following THA.

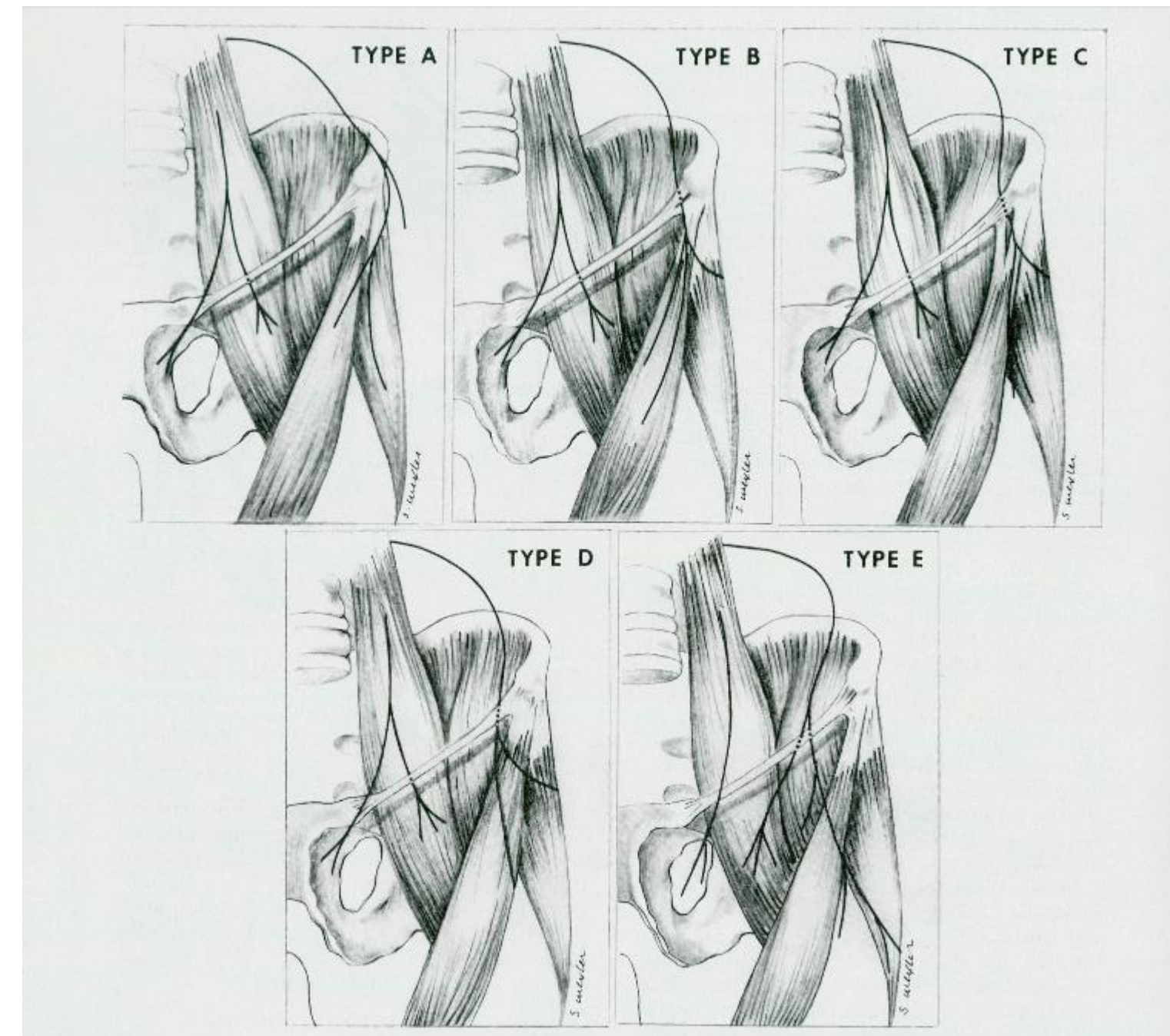


Figure 1: Variable course of lateral femoral cutaneous nerve. Grant's Dissector, 12th ed.

MATERIALS AND METHODS:

This case series comprised of 9 patients receiving an ultrasound guided SIFI nerve block as an analgesic adjunct for total hip arthroplasty was approved by Duke's Institutional Review Board. Initially, the anterior superior iliac spine (ASIS) is palpated. A linear transducer on an S-nerve ultrasound (SonoSite, Bothell, WA) was placed in the inguinal crease to identify the femoral artery in short axis. From the femoral artery, the probe was translated laterally to identify the Sartorius muscle. The sartorius was traced cephalad to its insertion on ASIS. The hypoechoic shadow of the ASIS is easily identifiable just cephalad to the insertion of the Sartorius muscle. Medial to the shadow of the ASIS lies the iliacus muscle. With the ASIS identified the medial end of the probe was rotated to point at the umbilicus. This is the final probe position. Layers identifiable from superficial to deep are subcutaneous fat, the internal oblique muscle, the transverse abdominus muscle, and the fascia iliaca overlying the iliacus muscle. A 4 inch block needle (Stimuplex, B-Braun; Bethlehem, PA) was advanced in an out-of-plane technique to puncture fascia iliaca and enter the superficial part of iliacus muscle. With the needle tip in iliacus muscle 2mL of local anesthetic were injected to confirm location just deep to the iliacus fascia. Once sub iliacus position was confirmed 30mL 0.2% ropivacaine with 1:400,000 epinephrine was incrementally injected superficial to the iliacus muscle and deep to the fascia iliaca (figure 2). Following completion of the injection the probe was translated medially toward the femoral nerve where caudomedial spread of local anesthetic was easily identified. Pain scores and opioid consumption were recorded in the electronic medical record and values at 1, 4, 8, 12, and 24 hours were analyzed.

RESULTS:

Nine out of 9 patients were successfully blocked using the SIFI approach, 6 were included in postoperative pain analysis. The 3 patients excluded were removed due to preexisting chronic pain. Lack of sensation was demonstrated in LFCN distribution from the greater trochanter to the superolateral aspect of the knee. Additionally, anterior femoral cutaneous nerves were anesthetized without significant loss of quadriceps function. Mean pain scores during the 12 hours of the block were 4.64 on a 10 point scale. Mean opioid consumption was 4.79, 3.11, 4.38, 7.36, and 19.72 in milligrams of IV morphine equivalents at 1, 4, 8, 12, and 24 hours respectively (table 1). Cadaver dissections showed injectate reaching the femoral nerve when injected immediately deep to the fascia iliaca (figure 3).

Patient	Distribution	Anesthesia	Opioids					Pain					Notes *
			1 hr	4 hrs	8 hrs	12 hrs	24 hrs	1 hr	4 hrs	8 hrs	12 hrs	24 hrs	
1	LFC/Fem	Spinal	7.5	5.33	7.5	7.5	20	4	9	8	5	5	1
2	LFC/Fem	GA	0	3.33	0	8.33	16.67	2	2	0	6	5	1
3	LFC/Fem	Spinal	1.25	0	2.5	0	16.67	2	n/a	4	1	0	1
4	LFC/Fem	Spinal	5	10	6.25	15.83	20	7	7	8	6	9	1
5	LFC/Fem	Spinal	8.33	0	5	12.5	22.5	6	5	4	5	5	1, 2
6	LFC/Fem	GA	6.67	0	5	0	22.5	5	4	4	2	9	1
7	LFC/Fem	Spinal	1.25	5	11.25	8.33	25.83	7	7	9	9	7	1, 4, 5, 6
8	LFC/Fem	Spinal	10.33	29.67	10.83	28.33	39	10	10	10	9	6	1, 4, 7
9	LFC/Fem	Spinal	2.5 +PCA	PCA	PCA	PCA	PCA	4	4	4	3	4	1, 3, 4, 8

Table 1: Patient data showing distribution of nerve block, type of anesthesia, opioid consumption at 1, 4, 8, 4, and 24 hours, pain scores (0-10) at 1, 4, 8, 12, and 24 hours, and pertinent notes for each case. * Notes – (1) achy, (2) throbbing, (3) burning, (4) chronic pain, (5) patient at baseline pain level, (6) pain not related to surgical procedure, (7) 25mcg fentanyl patch, and (8) patient controlled analgesia.

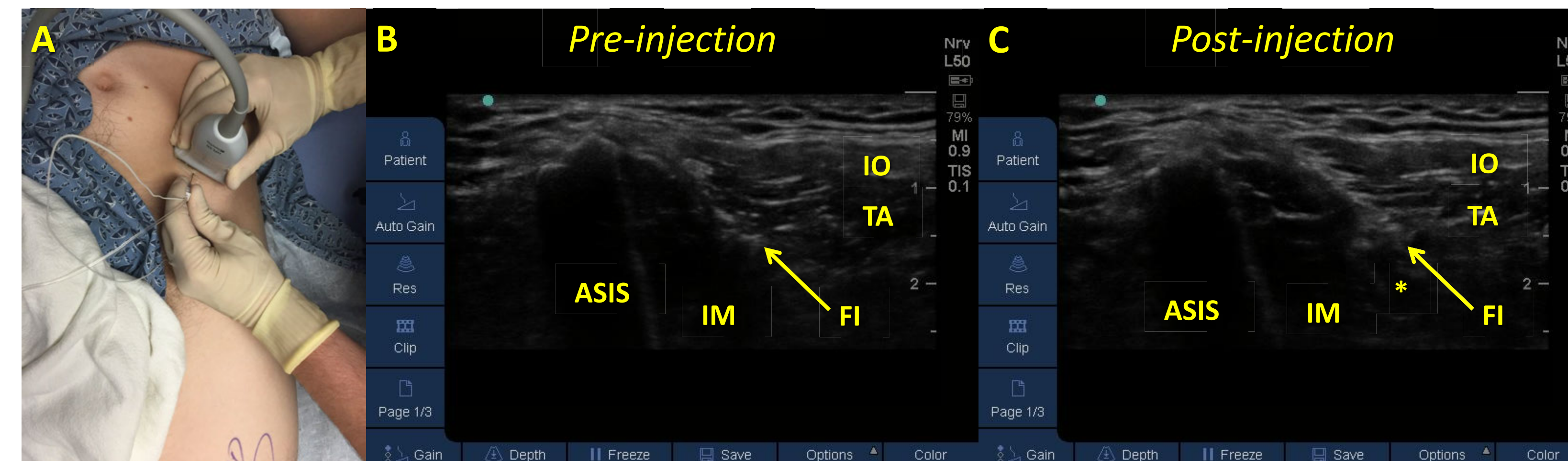


Figure 2: Ultrasound preparation and imaging. (A) Final ultrasound position with lateral aspect of probe superior to ASIS and medial aspect rotated to point at umbilicus. Needle is entering at center of probe in an out-of-plane fashion. (B) Pre-injection ultrasound image of ASIS, internal oblique muscle, transverse abdominus muscle, and iliacus muscle. (C) Post-injection ultrasound image showing local anesthetic deposition immediately beneath the fascia iliaca. IO – internal oblique muscle; TA – transverse abdominus muscle; IM – iliacus muscle, FI – fascia iliaca; ASIS – anterior superior iliac spine; * -- local anesthetic.

DISCUSSION:

The SIFI block appears to be a viable alternative to traditional fascia iliaca techniques or to femoral nerve block, both which have been used to aid in post-operative analgesia following THA. In this series, the SIFI block was 100% successful in blocking the LFCN and femoral nerve. Postoperative opioid consumption was decreased for the duration of the block with increased opioid consumption after block resolution. SIFI may be beneficial to aid in post-operative recovery by improving analgesia and decreasing opioid consumption. This is the first reported case series using the new SIFI block for postoperative analgesia following THA. Prospective studies of efficacy are now planned.

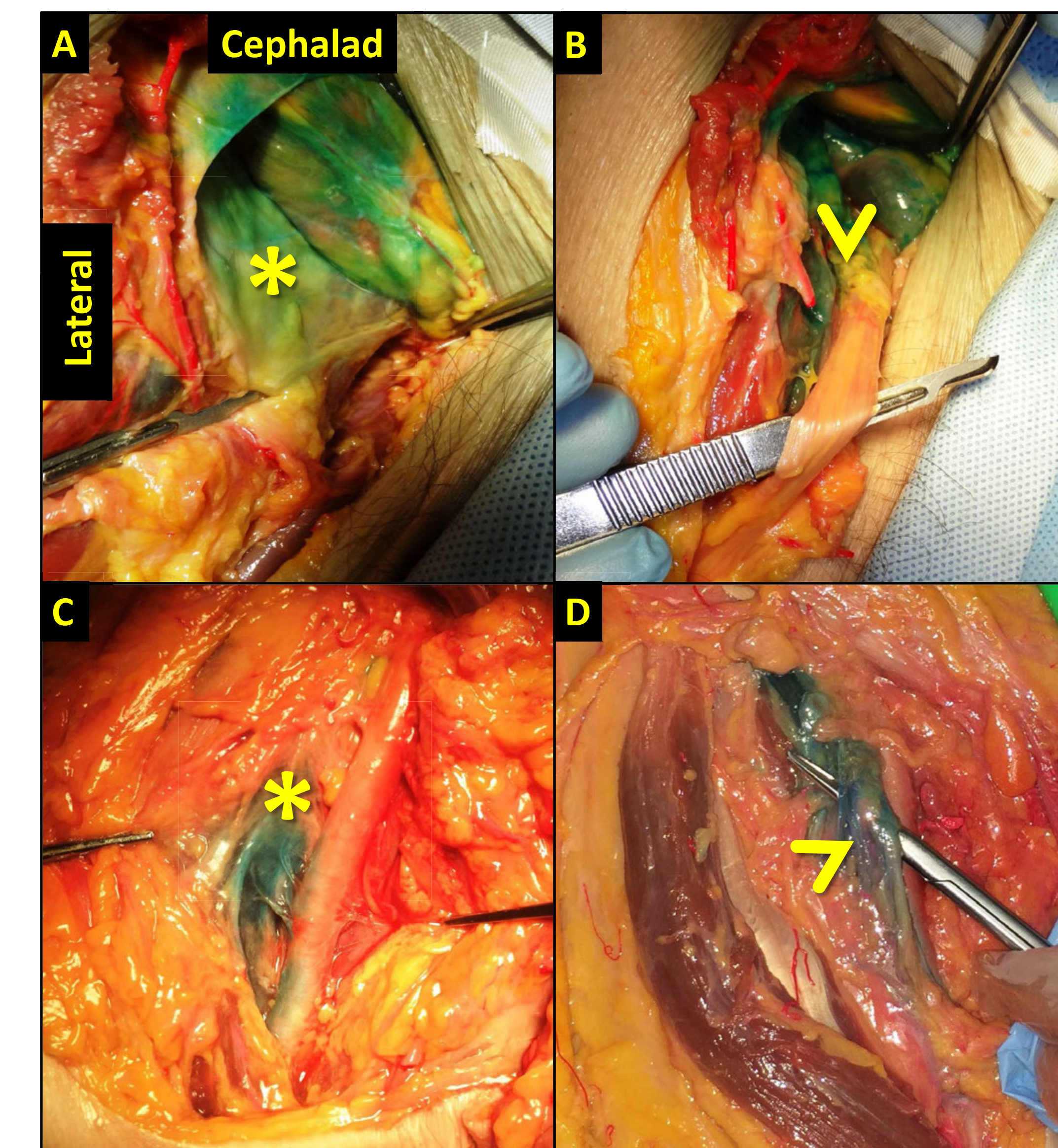


Figure 3: Cadaver dissection after injection of 30mL methylene blue dye (A & B) in the plane between transverse abdominus muscle and iliacus muscle. The dye spread between the fascial planes and did not reach either the lateral femoral cutaneous nerve nor the femoral nerve as seen by the absence of dye. (C & D) The dye covered lateral femoral cutaneous nerve and spread caudomedial to reach the femoral nerve as seen by the presence of dye. * - fascia iliaca; arrowhead - femoral nerve.

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