Validation of a Novel Intraarticular Posteromedial Surgeon-Administered (IPSA) Injection for TKA Analgesia

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INTRODUCTION: The adductor canal block (ACB) is used in place of the traditional femoral nerve (FN) block for total knee arthroplasty (TKA) analgesia because it primarily targets sensory branches of the FN (ie, saphenous nerve [SN] and its infrapatellar branch [ISN]), can preserve quadriceps muscle strength, and can facilitate early rehabilitation and mobilization. The objective of this cadaver study was to investigate an intraarticular posteromedial surgeon-administered (IPSA) single injection in terms of volume, reproducibility, and nerves reached by the injectate.

METHODS: A total of 5 cadaveric lower limb specimens were examined in sequential order. First, an anesthesiologist administered an ultrasound (US)-guided ACB using dilute indocyanine green dye targeting the SN and the nerve to the vastus medialis muscle (NVM; 10 mL each). Next, an orthopedic surgeon performed a medial parapatellar arthrotomy and placed an 18-gauge bevel needle 1 to 2 cm proximal to the adductor tubercle (AT) angled posteromedially to the axis of the femur. Fluoroscopy was used to document the needle angle, position, and spread of 10-mL methylene blue and radiopaque dye (Figure, top panels). After a second 10-mL injection, an anatomist dissected the knee. After cadaver 1, needle length was adjusted from 4″ to 1.5″. Needle angles measured from vertical for cadavers 1 to 5 were 30°, 40°, 55°, 30°, and 70°, respectively. Times between injections were 9 minutes (cadaver 1) and 5 minutes (cadavers 2 to 3). A single 20-mL injection was performed on cadavers 4 and 5 because of observation of minimal proximal spread in previous specimens. The US-guided ACB was repeated in cadaver 3 to confirm consistency of anatomic coverage.

RESULTS: Green staining from US-guided ACB reached the AC, NVM, and the SN, but did not reach the posterior capsule. The ISN was outside the AC in 3 of 5 cadavers and was not stained by the US-guided ACB. In cadavers 2, 3, and 5, blue staining of the ISN, NVM, and posterior capsule, but not the AC, was observed.

DISCUSSION: These results demonstrate that the IPSA technique consistently reached the ISN, NVM, and posterior capsule, with minimal proximal dye spread. Interestingly, dye did not reach the adductor canal, but did stain the nerves that are typically blocked for TKA pain via multiple injections. Furthermore, staining of the posterior capsule suggests potential analgesia not provided by the US-guided ACB. There is a reported variable effectiveness of ACB that may be explained by the anatomic variant identified in 3 of 5 cadavers in which the ISN coursed outside of the adductor canal (past the midthigh) and was not stained at all distally in the variant (cadaver 1) in which a US-guided ACB was administered. However, the ISN was reliably and reproducibly bathed and targeted by the surgeon-administered injection. This novel single-injection IPSA approach may be an efficient alternative to multi-injection periarticular infiltration or US-guided ACB when anesthesia resources are limited, given the reduction in administration time. These results support further investigation of this injection approach to confirm clinical outcomes.

SIGNIFICANCE/CLINICAL RELEVANCE: This is a novel intraarticular posteromedial surgeon-administered single injection that broadly bathes the nerves normally targeted by blocks for TKA analgesia, including the posterior capsule, and can efficiently reduce procedure time during surgery.

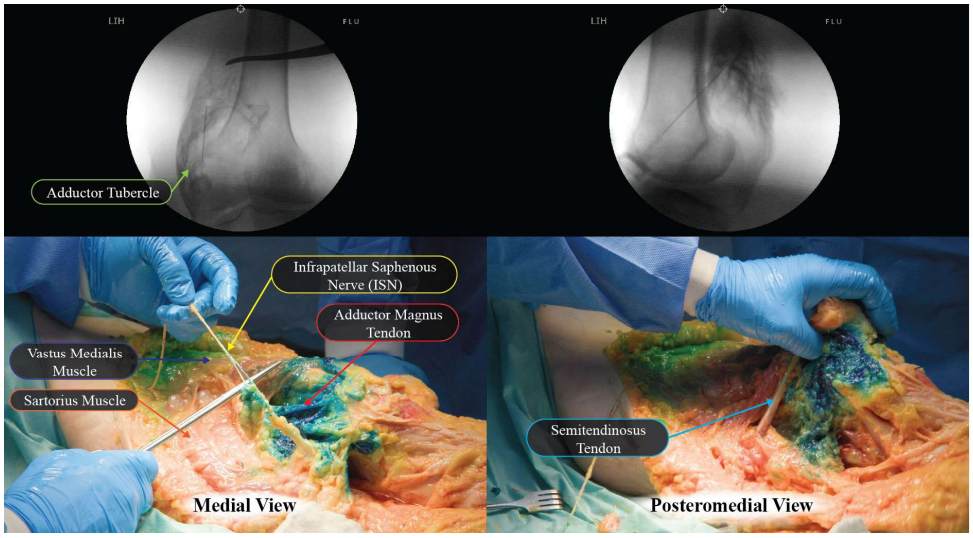

Figure. Anterior-posterior (top left) and lateral (top right) view fluoroscopy image demonstrating needle position and spread of injectate. Medial (bottom left) and posteromedial (bottom right) view of dye staining of the infrapatellar branch of the saphenous nerve, interval between the vastus medialis and sartorius muscles, and posterior capsule.