

Interconnections Among Midfoot Joints and Accuracy of Ultrasound-Guided Injection for Midfoot Arthritis

Soichi Hattori¹, Tomoya Ono¹, William Gamble², Patrick J. Smolinski², MaCalus Hogan¹

¹ Department of Orthopaedic Surgery, University of Pittsburgh, Pittsburgh, PA

² Department of Mechanical Engineering and Material Science, University of Pittsburgh, Pittsburgh, PA
patsmol@pitt.edu

Disclosures: Hattori (N), Ono (N), Gamble (N), Smolinski (N), Hogan (N)

INTRODUCTION: Midfoot arthritis is a frequent cause of chronic foot pain, commonly associated with trauma, inflammatory arthropathy and diabetes¹. Conservative management includes shoe modification, insert, and injections. The standard procedure involves fluoroscopy-guided injections into the naviculocuneiform (NC), medial intercuneiform, and second to fourth tarsometatarsal (TMT) joints separately, although a radiologic study has suggested interconnections among these joints². Furthermore, no anatomic studies have demonstrated the accuracy of ultrasound-guided injection into the NC joint to date. The hypotheses of this study were: (1) the NC, medial intercuneiform, and second to fourth TMT joints are interconnected in the normal foot, and (2) ultrasound-guided injection into the NC joint accurately delivers intra-articular solution.

METHODS: Ten fresh-frozen cadaveric right feet were thawed overnight. Using a portable 12-MHz ultrasound machine (Vscan, GE Healthcare), 1 cc of 0.5% methylene blue was injected into the NC joint with an 18-gauge needle using an out-of-plane approach (Figure 1). Ultrasound-guided injection was performed by two board-certified orthopedic surgeons (SH, TO). After five minutes, open dissection was performed to confirm intra-articular delivery into the NC joint. The spread of dye to adjacent joints was also recorded.

RESULTS: Delivery of dye into the NC joint was confirmed in nine out of 10 specimens (90%). One specimen with failed NC injection and one with osteoarthritis of the medial intercuneiform joint on dissection were excluded from the distribution analysis. Among the remaining eight specimens, dye spread from the NC to the medial intercuneiform and beyond the second TMT joints in six (75%), four of which also demonstrated distribution to the fourth TMT joint (Figure 2). In one specimen, dye remained localized to the NC, and in another, it spread to the NC joint and medial intercuneiform joints only.

DISCUSSION: This cadaveric study demonstrated that ultrasound-guided NC joint injection is highly accurate (90%) and frequently distributed to adjacent medial intercuneiform and second to fourth TMT joints (75%).

SIGNIFICANCE/CLINICAL RELEVANCE: The findings suggest that a single NC joint injection can treat multiple midfoot joints. Compared with fluoroscopy, which often requires multiple injections, involves radiation exposure, and increases cumulative corticosteroid dose, ultrasound-guided injections provides precise targeting, eliminates radiation exposure, reduces corticosteroid dose, and allows procedures in outpatient clinics without radiology visit or operating room use.

REFERENCES: ¹Siraj, Am J Orthop 2008; ²Hansford, AJR 2019.



Figure 1: (A) A portable ultrasound probe was placed between medial cuneiform and navicular. (B) 0.5% methylene blue was introduced into the NC joint with an out-of-plane method below ATT. Black arrow; entry of the needle. (C) White arrow; tip of needle in the ultrasound image, ATT; Anterior Tibialis Tendon

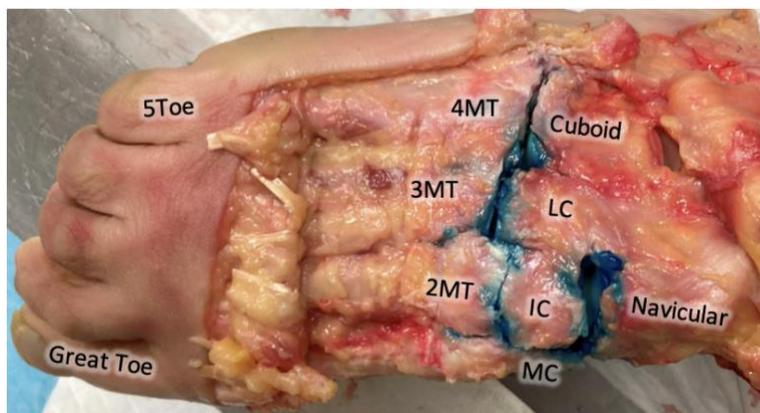


Figure 2: Cadaveric dissection following injection. Top lateral view of right ankle. Dye distribution into the NC (between Navicular and IC/MC), medial intercuneiform (between MC and IC), second TMT (between 2MT and IC), third TMT (between 3MT and LC), and fourth TMT (between 4MT and Cuboid) joints indicates both the accuracy of injection and interconnection of among these joints. MT; Metatarsal, MC; Medial Cuneiform, IC; Intermediate Cuneiform, LC; Lateral Cuneiform