Second Metatarsophalangeal Joint Arthrography: A Cadaveric Correlation Study

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Arthrography of the second metatarsophalangeal joint is an important diagnostic tool to evaluate the integrity of the plantar plate and to aid in the decision process for surgical intervention. A variety of filling patterns have been identified with lesser metatarsophalangeal joint arthrography and their significance with soft-tissue pathology remains to be completely understood. The purpose of this cadaveric study was to evaluate dye patterns in a series of arthrograms of the second metatarsophalangeal joint and to correlate them with identifiable anatomic lesions or structural variants. Thirty-nine cadaveric specimens (including 28 matched pairs) underwent second metatarsophalangeal joint arthrography with a colored radiopaque dye. Arthrographic findings were observed and recorded. Specimens exhibiting dye extravasation outside of the capsular constraints of the joint were dissected to discover any soft-tissue abnormalities. Twenty-one percent of specimens exhibited abnormal extravasation of dye outside of the joint capsule. A plantar plate tear was identified in 2 of these specimens. Filling of the first intermetatarsophalangeal bursa occurred in 6 specimens. However, because this finding was identified in 2 matched pairs, an anatomic variance is suggested rather than a pathologic entity. This cadaveric study shows that anatomic variances exist concerning the second metatarsophalangeal capsule and that arthrography should be correlated with the clinical scenario. (The Journal of Foot & Ankle Surgery 43(4): 231-240, 2004)

Key words: plantar plate, arthrography, second metatarsophalangeal joint, instability

The integrity of the second metatarsophalangeal joint (MTPJ) is important in the stabilization of the second digit. Capsular pathology is thought to be associated with pain and deformity (1–3). Arthrography of the lesser MTPJ has been used to identify capsular and plantar plate tears. Lesser MTPJ arthrography is a valuable diagnostic technique used to determine capsular integrity and it aids the surgeon in recommending surgical repair (4). However, the role of arthrography and second MTPJ pathology is still being established. Although arthrograms showing dye extravasation into the flexor tendon sheath are considered positive for plantar plate rupture, other extravasation patterns are less clear (4–6). Powless and Elze (3) have identified filling abnormalities concerning the MTPJs in a symptomatic population and have created a classification system for capsular tears. It is unclear if an abnormal arthrographic finding represents a tear in the capsule of the MTPJ or if it represents a normal variant. It is known from collective arthrographic experience with other joints in the body that anatomic variances and/or synovial outpouchings exist and this may confuse the diagnostic workup (7–16). Such variances in second MTPJ arthrography have yet to be established. The purpose of this study was to evaluate the dye patterns identified with standard arthrography of the second MTPJ in a cadaveric model and to attempt to correlate them with identifiable capsular lesions. Although cadaveric feet have been studied to gain better understanding of the normal anatomy of the second MTPJ, there has been no investigation of the effects of arthrography on cadaveric MTPJs.

Anatomy

The anatomy of the second MTPJ has been extensively studied in cadavers (17–19). The capsule of the second MTPJ is formed by the confluence of several structures. It is mainly composed of ligamentous structures and receives additional support from the tendons spanning the joint. The plantar aspect consists of thickened fibrocartilaginous tissue termed the plantar plate (18, 19).

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Dorsally, the extensor expansion of the extensor digitorum longus and brevis tendons forms the roof of the joint. A bursa is located on the dorsal aspect of the joint line between the long extensor tendon of the toe and the dorsal aponeurosis (19). The expansion is composed of 2 main components. The proximal sling portion envelops the proximal phalanx, whereas the distal wing portion serves as the main insertion site for the lumbrical on the medial aspect of the joint (19). The first lumbrical is a unipennate structure and originates from the tendon of the flexor digitorum longus and courses inferior to the deep transverse ligament as it inserts onto the second digit.

The first and second dorsal interossei are retained on the MTPJ capsule via fibrous connections and are considered extracapsular structures (19). They mainly originate from their adjacent metatarsal shafts and have many insertions onto the following structures: transverse metatarsal ligament, capsule of the MTPJ, plantar plate, extensor sling, and base of the proximal phalanx (19).

The collateral ligaments create the medial and lateral walls of the capsule. They are fanlike structures that attach to the epicondyles of the metatarsal neck. The anterior division, also termed the phalangeal collateral ligament, attaches to the plantar medial and lateral base of the proximal phalanx (17). The posterior division, termed the accessory collateral ligament, attaches into the plantar plate and serves as its major proximal attachment to the metatarsal (17). Interestingly, some investigators noted a larger size of the fibular collateral ligaments when compared with the tibial collateral ligament of the same metatarsal; however, the significance of this observation is unknown (17).

The plantar plate serves as the weightbearing platform of the metatarsal head (18). It is constructed of a thick fibrocartilaginous tissue, similar to the fibrocartilage found in the knee meniscus and the annulus fibrosis of the spine (17, 18, 20). The distal attachment into the base of the proximal phalanx is the strongest attachment of the plate and mainly inserts as medial and lateral bundles instead of a uniform insertion across the phalangeal base (4). The proximal attachment to the metatarsal head is located behind the plantar articular condyle and is the weakest attachment of the plantar plate, and is formed of synovial textured tissue (17, 18). There are medial and lateral synovial recesses separated by a central frenulumlike structure located at the proximal attachment site (Figs 1 and 2). Additionally, the plantar plate serves as a major distal insertion point of the plantar fascia and likely plays a role in the windlass mechanism of the foot. The deep transverse intermetatarsal ligament attaches to the medial and lateral aspects of the plantar plate. The flexor tendon apparatus is intimately associated with the undersurface of the plantar plate and serves as the roof for the gliding function of the flexor digitorum longus tendon to the second toe.

Microscopically, most of the collagen fibers of the plantar plate are arranged in a longitudinal interwoven fashion as a continuation of the plantar aponeurosis and are concentrated on the dorsal two thirds of the plate (17, 18). The intermetatarsal ligament also continues onto the plantar plate in a transverse orientation; this arrangement is more prominent on the plantar one third of the plate (17).

FIGURE 1 View of second metatarsal head with the digit reflected superiorly and the plantar plate reflected inferiorly. Note the frenulumlike structure (arrow) and the adjacent synovial pouches (asterisks).

Materials and Methods

Thirty-nine fresh-frozen cadaveric forefoot specimens were used in this study. The average age was 73 years (range, 54 to 92 years). Twenty-eight specimens were matched pairs; of the remaining 11 specimens, there were 7 left feet and 4 right feet. All specimens were thawed at room temperature in damp towels. The specimens included in this study had not had previous surgical intervention involving the forefoot and had no obvious gross deformities. Radiographic imaging was performed to rule out osseous pathology of the forefoot.

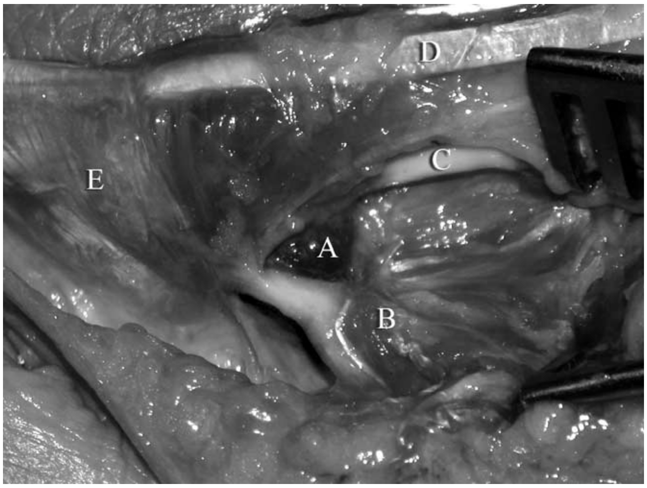

FIGURE 2 Dorsal medial view of first intermetatarsal space, showing intact plantar medial synovial recess (A) of the second MTPJ (distended with intraarticular dye). Note close association of the reflected first dorsal interosseous muscle and the tendon (B). Also identified are the second metatarsal shaft (C), the extensor longus tendon (D), and the extensor expansion (E).

Testing Sequence

A colored radiopaque solution containing 90% iohexol (Omnipaque 300; Amersham Health, Princeton, NJ) plus 10% methylene blue was prepared and placed in a 10-mL syringe with an attached 25-gauge needle. Under direct fluoroscopic control, the needle was inserted into the second MTPJ through a dorsal medial approach. An identical approach to enter the joint was used on each specimen to help insure consistency in joint filling. Care was taken to not violate any surrounding tendon-sheath structures. Additionally, the needle was only inserted into the dorsal aspect of the joint to avoid invasion of the flexor sheath. Before dye injection, the needle position was verified with a Fluoroscan (Hologic Fluoroscan Systems, Northbrook, IL).

The colored radiopaque dye was injected and filling of the joint capsule was observed under fluoroscopic guidance. Once the joint capsule distended and ample resistance was encountered, the needle was removed. In those specimens in which dye extravasated outside of the capsule, the needle was removed when resistance was encountered or a maximum of 3 mL was injected. Postinjection images were obtained. The amount of dye injected was recorded for all specimens, as were the patterns and locations of dye distribution. To avoid interoperator variance in technique, all arthrograms were performed and evaluated by 1 author (N.M.B.) with an identical injection approach.

Any specimen with an arthrogram exhibiting extravasation of dye outside the confines of the MTPJ, as defined by Karpman and MacCollum (6), was dissected to identify the reason for extravasation. Both dorsal and plantar approaches were used for dissection. The flexor tendon sheaths were evaluated for dye extravasation. The interossei tendons and the medial lumbrical were also examined. In some instances, further joint distension was used to localize the capsular tear. When a capsular tear could not be identified despite further joint distension, another dye solution containing a contrasting orange color was injected intraarticularly through a different portal. If a capsular tear could not be identified, the orange dye allowed for identification of the general area of dye extravasation.

Results

Arthrograms exhibiting dye extravasation outside of the capsular confines of the second MTPJ occurred in 18 specimens. The remaining 21 specimens showed 3 distinct areas of dye collection: the dorsal joint line and the proximal plantar medial and lateral synovial recesses. Because a dorsal approach was used to enter the joint, the dorsal distribution of dye was visualized first. Next, outlining of the joint line occurred followed by filling of the proximal plantar medial and lateral recesses (Fig 3). The plantar lateral recess is slightly larger and extends more proximally than the plantar medial recess. The frenulum of the synovial attachment was identifiable. This proximal plantar area contained the largest collection of dye and was most noticeable on radiographic examination. These specimens accepted an average of 0.8 mL (range, 0.5 to 1.5 mL).

In 2 specimens, dye first filled the confines of the capsule and then extravasated into the flexor tendon sheath. Postarthrography dissection showed that both specimens had small tears in the plantar plate immediately proximal to the phalangeal base (Fig 4).

In 6 specimens, dye extravasted into the first interspace once the joint capsule was completely distended with dye. This was a well-defined oval area of dye collection directly adjacent to the medial collateral ligament (Fig 5). Postarthrography dissection showed the medial intermetatarsophalangeal bursa. Of these 6 specimens, 4 were bilateral matched pairs (2 pair of feet). All bursae, except for 1, ruptured and dye subsequently filled the intermetatarsal space. A distinct communication between the joint and the bursa was identified in only 1 specimen despite full dissection with adequate visualization and further joint distension. However, the general area of extravasation was able to be determined in these particular cases.

Extravasation from the needle track and leakage of dye into the first intermetatarsal space occurred in 10 specimens. Dissection determined no identifiable capsular le-

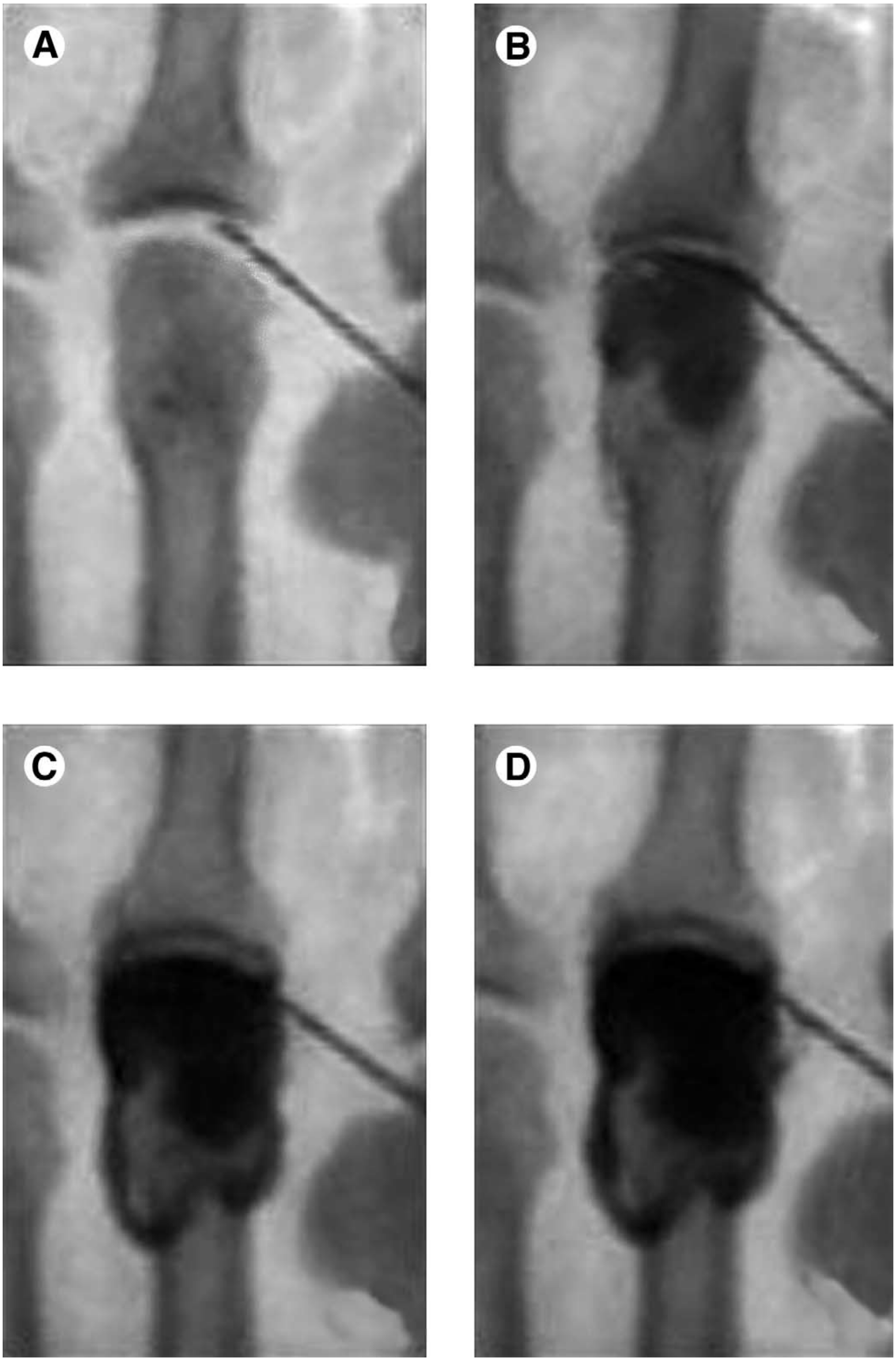

FIGURE 3 Normal arthrogram with intact second MTPJ. (*A*) Verification of needle placement into the second MTPJ before injecting. (*B*) Dye concentration in the dorsal recess with initial injection. (*C*) Joint outlined with subsequent filling of the plantar medial/lateral recesses and the frenulum. (*D*) Joint distension and intact capsule.

sion. This was confirmed with the orange dye injection through a different portal site. The dye leaked out from the initial dorsal medial portal site into the first interspace. In these situations, the capsular structure of the second MTPJ was intact and the path of least resistance was the needle track. These were not classified as abnormal studies because these specimens had an intact MTPJ capsule with dissection.

FIGURE 4 Dissection photograph showing small tear of plantar plate just proximal to phalangeal base. The subtle tear is made visible by the colored dye extravasating from the tear (arrow). Flexor tendons retracted (arrow head).

Discussion

The use of arthrography to aid in the diagnosis of second MTPJ pathology was popularized by Karpman and MacCollum (6) in 1988 and by Yao et al (4) in 1994. As arthrography becomes more widely used, the significance of various arthrographic patterns surrounding the second MTPJ will be further established. Karpman and MacCollum (6) defined an abnormal arthrogram for a plantar plate tear as one in which dye extravasates into the flexor sheath. Powless and Elze (3) believe this may occur in a location adjacent to the flexor sheath. Interpretation of arthrograms exhibiting generalized plantar extravasation is less clear. Other findings besides flexor-sheath involvement may be appropriately classified as abnormal studies, but may not be indicative of a pathologic entity based on the arthrogram alone (21).

There are several anatomic and functional features unique to the second MTPJ that may predispose it to capsular injury and dislocation. It is the only MTPJ to have an unopposed lumbrical and no plantar interossei insertions (19). The significance of these anatomic features is unknown and may promote a force vector superior to the axis of the second metatarsal. Bade et al (22) showed that the intrinsics function as dorsiflexors with MTPJ hyperextension promoting a claw-toe deformity. Additionally, the second metatarsal is typically the longest metatarsal and the first of the lesser metatarsals to bear weight in gait (19, 23).

Isolated second metatarsalgia occurs for a variety of reasons and arthrography may be a valuable tool in the evaluation process. According to Karpman and MacCollum (6), the indications for second MTPJ arthrography are as follows: plantar plate abnormalities, metatarsalgia, differentiation of intraarticular versus extraarticular pathology, and arthritis. Yao et al (4) used arthrography to evaluate the collateral ligaments. More recently, Powless and Elze (3) have used arthrography to identify capsular tears of all MTPJs. The major advantage of arthrography is the ability to evaluate the integrity of the capsule on a real-time basis. This aspect becomes more relevant when abnormal arthrograms are encountered.

The presence of the first intermetatarsophalangeal bursa may be identified on some arthrograms but its significance is unclear. Hartman (24) in 1896 described the intermetatarsophalangeal bursa located between adjacent interossei tendons of the interspaces. Since then, other investigators have also recognized its existence, but the literature remains limited (25, 26). Bossey et al (27) studied the structure and the location of the intermetatarsophalangeal bursa of the lesser interspaces by infiltrating the bursa with heated gelatin dye in cadaveric feet. The intermetatarsophalangeal bursa was described as a flattened, oval structure composed of loose connective tissue, located dorsal to the transverse metatarsal ligament (27, 28). It may extend from the metatarsal neck to the proximal phalanx; however, some investigators believe the intermetatarsophalangeal bursa of the first interspace does not extend past the transverse ligament (27–30). The size of the bursa may vary but it is typically described from 2 to 3 cm in length and up to 1 cm in height and width (27–30). In a magnetic resonance arthrographic and bursographic study, Theumann et al (31) stated that the first intermetatarsal bursa resembled a tendon sheath covering the adductor hallucis tendon. Zanetti et al (32) considered intermetatarsal bursal-fluid collection physiologic with a transverse diameter less than 3 mm on magnetic resonance imaging. Intermetatarsophalangeal bursa on magnetic resonance imaging has also been identified concomitantly with plantar plate ruptures (33). Some investigators recognized that communications might occur between a bursa and the joint (4, 24, 27). In our cadaveric study, we identified the first intermetatarsophalangeal bursa in 6 specimens with second MTPJ arthrography. However, because this finding

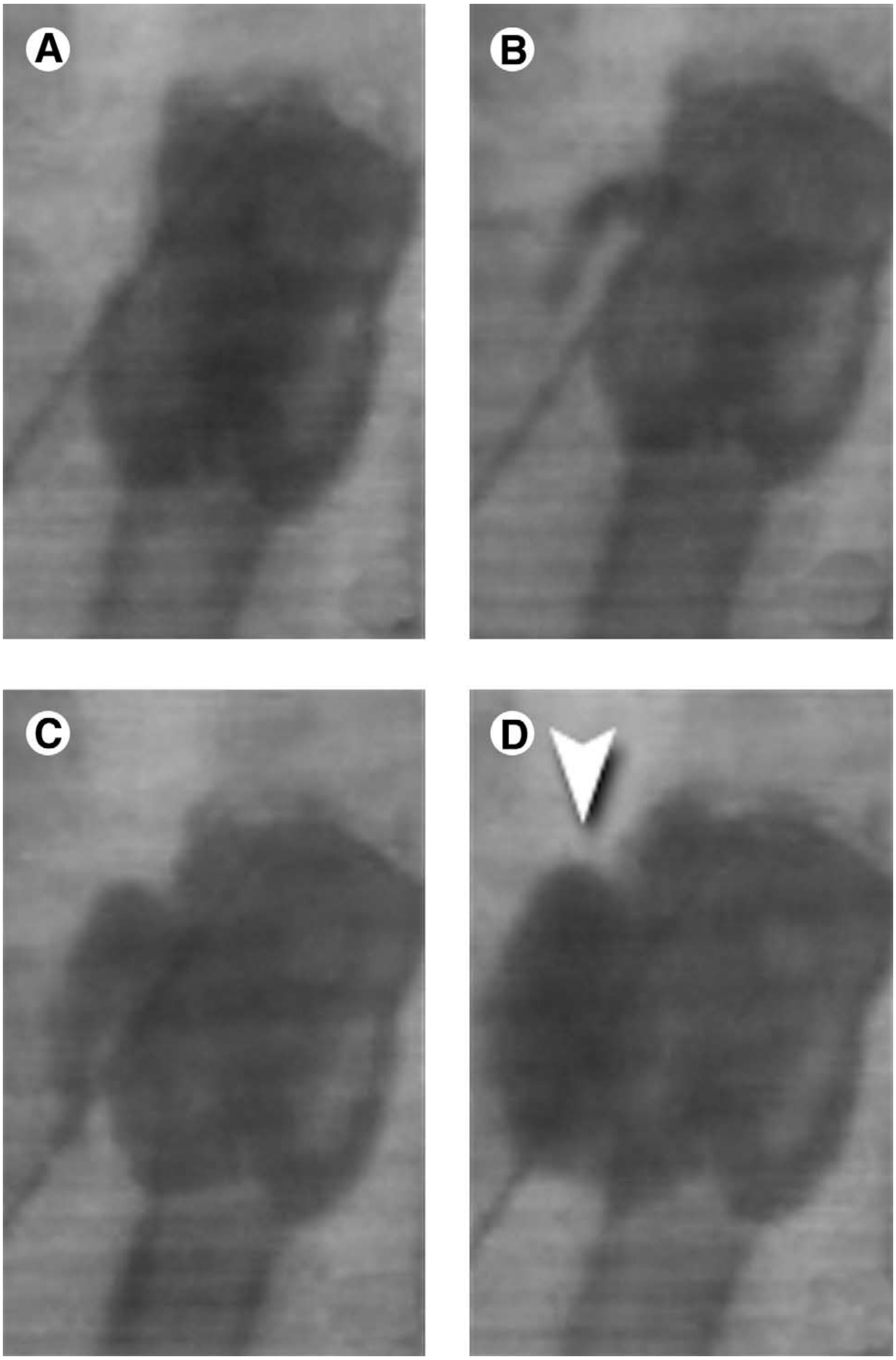

FIGURE 5 Arthrogram exhibiting an intact first intermetatarsophalangeal bursa (arrow). (*A*) Arthrogram filling all 3 recesses. (*B*) Extravasation from the medial collateral ligament complex through the small portal. (*C*) Further filling of the intermetatarsophalangeal bursa. (*D*) Intact intermetatarsophalangeal bursa adjacent to the medial collateral ligament complex.

was identified bilaterally in 2 matched pairs, an anatomic variance is suggested rather than a pathologic entity.

Collateral ligament insufficiency has long been suspected in the pathogenesis of MTPJ subluxation and crossover second toe deformity. The lateral collateral ligament complex is insufficient because the digit is usually deviated dorsomedially with contracted medial collaterals and attenuated or torn lateral collaterals (34). Because the intermetatarsophalangeal bursa occurred medially in our specimens, this further supports an anatomic variant because one would expect any pathologic extravasation to occur laterally. The specimens in this study did not have grossly deviated digits. Lateral MTPJ dye extravasation with a medially dislocated digit is more suggestive of a pathologic process.

To date, there has not been any investigation describing the effects of second MTPJ arthrography in the cadaveric model. Because we only evaluated 39 random feet, there are likely other anatomic variances and/or abnormal findings not identified in this sample size. In fact, there are other arthrographic entities identified in clinical practice (ie, lateral MTPJ extravasation) that were not seen in these cadavers and could not be analyzed (3). Evaluating feet with dislocated digits may offer more insight into the various arthrographic patterns of the second MTPJ not represented in this study.

There are several potential sources for error in this investigation. Although our most common occurrence was needle-track extravasation, its incidence is admittedly grossly inflated compared with clinical practice. Because this was a cadaveric study, the capsular tissues may have undergone some degree of degeneration, which may explain the inability of the tissues to respond to the fluid overload, producing the needle-track leakage. Also, the advanced age (average, 73 years old) of the specimens may have contributed to the fragility of the tissues, allowing for easier capsular disruption from fluid overload. Arthrograms posses an inherent ability for operator error even in the most experienced hands. Longer needles and poor technique may result in inadvertent advancement through the plantar plate, and will illicit a false positive for plantar plate tear. This is shown by dye extravasation into the flexor sheath and not into the joint capsule as well. Theoretically, numerous failed attempts to perform an intraarticular injection may render the portal site incompetent and likely produce an extravasation via the needle-track mechanism. Additionally, the size of the needle may also contribute to portal site dye extravasation because a smaller size needle is less likely to promote fluid leakage. The authors typically use a 25-gauge needle when performing arthrograms on our patients, and they kept this constant throughout the study to simulate clinical practice.

Identifying incompetent areas in the collateral ligaments proved to be a difficult task and almost universally unsuccessful, even with full dissection and visualization. In only 1 of 6 specimens was a specific capsular lesion identified. Locating an interspace capsular tear intraoperatively may also prove to be unrewarding because one cannot achieve the same visualization as with a cadaver. However, the cadaveric tissues in this study were heavily stained with methylene blue, likely impairing the ability to locate a small capsular tear. Attempting to localize the capsular lesion from within the joint may be more effective, a technique we did not consider during this study.

Because all but 1 of the intermetatarsophalangeal bursae in 6 specimens ruptured, some could argue that rupturing of the bursal segment is a pathologic entity as an abnormal arthrogram is encountered. However, this may be secondary to inexperience with MTPJ arthrography without using real-time imaging. Given the composition of the bursa as synovial tissue, it is no surprise that these structures are fragile and unforgiving when manually distended with a large amount of fluid. The specimens exhibiting bursa rupture showed fluid leakage from the proximal aspect of the bursae, and extravasation occurred proximally into the interspace (Fig 6). Interestingly, all bursae maintained an intact shape during distension until a rupture was caused. An important finding is that the ruptured bursa always occurred proximally and the distal aspect of the bursa maintained its semicircular shape.

FIGURE 6 Drawing showing arthrogram with intact medial bursa (left) and ruptured bursae (right).

Yao et al (4) suggested collateral ligament damage is evident when the intermetatarsal bursae are identified on conventional arthrography and suggested that a varus/valgus stress test of the digit may diagnose the entity. This may be especially useful if a real-time study was not used and one suspects needle-track extravasation into the interspace (Fig 7). Unfortunately, this technique only represents the authors' anecdotal experiences. Its validity in the face of chronic attenuation is unknown and no guidelines exist for quantifying a digital transverse plane stress test. The integrity of the collateral ligaments with arthrography may be difficult to interpret and abnormal studies should be correlated with the clinical scenario. Magnetic resonance imaging may be helpful in evaluating the collateral ligaments. In fact, both origin and insertion of the phalangeal collateral ligament and accessory collateral ligament are identifiable (35, 36). Injured ligaments are interpreted as increases in signal. However, evaluation of the collateral ligaments with magnetic resonance has been poorly described in the literature and may be prone to increased signal-to-noise artifact.

A plantar plate tear was identified in 2 specimens. Both tears were small, slitlike separations of the plate and located just proximal to the phalangeal rim of the phalanx. Because a small number of tears were identified in this study, it is difficult to make any steadfast conclusions. However, the tear location correlates with our clinical experience with

FIGURE 7 Arthrogram with localized first intermetatarsophalangeal dye adjacent to metatarsal head secondary to needle-track extravasation (arrow). May be mistaken for the intermetatarsophalangeal bursa if real-time arthrography is not used.

chronic ruptures that most damage to the plantar plate occurs in close approximation to the phalangeal base, which is the stronger attachment. The weakest plantar plate attachment is to the metatarsal neck (17). Yao et al (37) also observed that plantar plate derangements occur near the distal attachment of the plantar plate. Based on Deland et al's (17) histologic description, a thin area exists close to the plantar plate attachment into the phalangeal base. We believe the insertion may have a weak area or a rupture zone. However, studies are needed on both a histologic and a clinical level to further illustrate the location and types of plantar plate injury.

Conventional arthrography is the best modality available to show capsular integrity of the second MTPJ on a real-time basis. Because arthrography is an invasive technique, many surgeons rely on magnetic resonance imaging, but it has its limitations with respect to the plantar plate. Injury to the plantar plate is typically seen as a focal, intrasubstance increase in signal of the plate on a T2-weighted image (33, 35, 37). In some instances, a discrete tear may be visualized. A poorly defined area exists on magnetic resonance imaging at the distal aspect of the plantar plate immediately adjacent to the base of the proximal phalanx in the rupture zone area, which may make ruptures difficult to identify. Additionally, undercutting of the plantar plate by the hyaline cartilage on sagittal reformats may be mistaken for a frank plantar plate rupture (33). Therefore, one should take care when evaluating the integrity of the plantar plate with magnetic resonance imaging.

The amount of fluid injected into the joint and the ease of injection are critical aspects of the arthrogram that are often overlooked. In this study, the normal second MTPJ accepted an average of 0.8 mL of fluid. This finding is consistent with the literature; however, it is often reflected as an anecdotal experience (4, 6, 33). In a volumetric cadaveric study of 10 pairs of feet, Mizel et al (38) reported that the second MTPJ accepted an average of 0.51 mL (range, 0.4 to 0.6 mL). They used a Jamar pinch-strength meter (Sammons Preston Rolyand, Bolingbrook, IL) to limit the pressure to 4 pounds. In our study, we injected until adequate resistance while visualizing the capsular distension under fluoroscopic guidance. The differences in average joint volume between the 2 studies may be that we fully distended the joint capsule, whereas Mizel et al's (38) study may have underdistended the joint.

The importance of monitoring the volume during arthrography is that, at approximately 1 mL of fluid (near the normal capacity of the second MTPJ), the joint itself should be adequately distended. At this point, the quality of the flow should be monitored. Obviously, with increased resistance to further volume input, the study is complete. The fluid should not be forced into the joint because it may produce an iatrogenic capsular tear from gross volume overload and, of course, may produce needle-track extravasation.

Because the total volume of dye is not necessary to evaluate the competency of the capsule, we limited the maximum injection to 3 mL for this study. In this cadaveric study, the resistance to fluid input in a distended MTPJ was not as obvious as that of a living subject and is likely the cause for the high percentage of needle-track extravasations. However, understanding the potential for needle-track extravasation to produce an abnormal arthrogram in the face of intact capsular structures should prevent misinterpretation and unnecessary surgical intervention. Yao et al (4) also cautioned against this occurrence.

Although arthrography is an excellent modality to evaluate the capsular and ligamentous integrity of any joint, its ability to correlate extravasation with the clinical symptoms has long been criticized (39–43). Much of the literature on joint arthrography is centered on the wrist, which has shown extravasations and communications in asymptomatic joints. One prospective study identified 75% of 46 symptomatic wrist arthrograms had communications in the contralateral asymptomatic wrist (39). They question the validity of a unilateral arthrogram and suggest a contralateral study for a control. Additionally, older patients are suspected to have increased perforations of radiocarpal joints, therefore complicating the significance of a diagnostic positive study (44–48). Although wrist arthrography does not directly correlate to arthrography of the second MTPJ, it offers insights into the advantages and pitfalls of diagnostic arthrography.

Powless and Elze (3) described several arthrographic patterns of mainly the second MTPJ. In addition to identifying plantar plate lesions, they visualized 20 of 58 patients with intermetatarsal space involvement or extravasation of dye into the interosseous tendons. These cases were considered pathologic and underwent primary repair; however, the authors admitted these deficiencies in the capsule were often subtle. In our cadaveric model, we showed difficulties identifying the lesions responsible for intermetatarsal dye extravasation because we could not identify 5 of 6 collateral ligament lesions despite full dissection and clear visualization. It is possible that dye could have extravasated from a deficiency between the anterior and posterior division of the collateral ligament rather than from a frank tear or communication.

Interestingly, Powless and Elze (3) performed repeat arthrograms on 5 patients after undergoing primary plate repair for arthrograms exhibiting only flexor involvement. Four of 5 postoperative arthrograms returned to normal. This finding supports the role of plantar plate repair. Additionally, 7 of 7 patients with intermetatarsal dye extravasation underwent surgical repair and postoperative arthrograms returned to a normal state. Their retrospective study indicates that repair of the MTPJ capsule in the presence of an arthrogram indicating collateral ligament incompetence is efficacious.

Before surgical procedures may be performed on digits on the basis of abnormal arthrograms, especially when first intermetatarsal dye extravasation is detected, further investigations into the significance of these capsular lesions must be clarified. An abnormal arthrogram clearly identifies deficiencies regarding the integrity of the second MTPJ, but may not be indicative of a pathologic entity based on the arthrogram alone. Regardless of the arthrographic findings, a symptomatic unstable digit may need surgical intervention (2, 3, 5, 49–52). The findings in this cadaveric study suggest anatomic variance exists in the second MTPJ capsule, and the arthrogram should be correlated with the clinical scenario. Clinical studies that include a comprehensive diagnostic work-up are needed to establish the specificity and sensitivity of second MTPJ arthrography.

Conclusion

Second MTPJ arthrography is a valuable diagnostic tool used to identify intraarticular pathology and to evaluate joint capsule integrity; however, the arthrographic variances are still being established. This study evaluated arthrographic patterns of the second MTPJ in the cadaveric model. Results showed an abnormal arthrogram in 21% of specimens. A plantar plate tear was identified in 2 specimens with abnormal arthrograms. This study shows that anatomic variances exist concerning the second MTPJ capsule and that arthrography should be correlated with the clinical scenario.

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