



Post traumatic hallux valgus – a rupture of the medial collateral ligament

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Although hallux valgus is often an etiology steeped in biomechanical abnormalities throughout the foot, in rare instances its presence can be due to trauma to the first ray. There are few reports of post-traumatic hallux valgus, none by way of motor vehicle accident. In this instance, a shoed, restrained passenger in a car accident soon thereafter developed this deformity. Suspicion of capsuloligamentous damage was confirmed through MRI. Here we discuss the evaluation and diagnostic tools that help confirm the diagnosis as well as discuss some treatment options.

Key words: capsule tear; hallux valgus; medial collateral ligament; motor vehicle accident; post traumatic

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The deformity of hallux valgus, first described by Carl Hueter in 1871, is characterized by a lateral deviation of the hallux with or without subluxation of the first metatarsophalangeal joint (MTPJ) [1,2]. Etiologies have been documented from equinus of the Achilles, pes planus, neuromuscular disease (cerebral palsy, cerebral vascular accident), posterior tibial tendon dysfunction and rupture, inflammatory (rheumatoid arthritis) [1]. One less common or documented etiology is post traumatic hallux valgus. This has been attributed to medial collateral ligament (MCL) tear, LisFranc injury, turf toe injuries, and medial plantar nerve injury secondary to ankle (tibial) fracture [3-7]. Specifically, tears of the MCL account for only six documented cases in the literature [3,6-8]. Here we describe a post traumatic rupture of the MCL of the first MTPJ after motor vehicle accident (MVA) by a flip-flop wearing restrained passenger, review imaging modalities that can assist in this diagnosis, and discuss treatment options.

Case Report

The patient, a 21 year old female, presented to our office 8 weeks after being a restrained passenger in a roll-over motor vehicle accident (MVA). There was no loss of consciousness or inability to weight-bear immediately after the accident by the patient. Triaged to a local emergency room, she was diagnosed with a shoulder contusion, facial abrasions, and negative pedal findings despite having some discomfort. Radiographs taken at this institution were negative for any acute trauma. (Figure 1) In the days following the accident, she was still having some discomfort to the left hallux and noticed upon standing that the toe was rotated into a slight valgus orientation (Figure 2). There was also bruising and swelling that persisted for weeks after the injury. Because of this deformity and continued pain and feeling of instability to the toe, greater on weightbearing, she presented to our office for evaluation two months after the date of injury.

Upon physical exam there was a mild amount of edema but no erythema or ecchymosis to the distal-medial foot. Tenderness was mild to the dorsal-medial aspect of the first MTPJ with increased pain on passive dorsiflexion at end range.

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Figure 1 Radiograph of the patient after initial injury taken in the emergency room. Although non-weightbearing, no valgus rotation is apparent to the hallux. Additionally, there is no evidence of osseous trauma (fracture, avulsions, loose bodies) about the 1st MTPJ.



Figure 3 Weight-bearing clinical photo transverse plane evaluation. There is no significant difference from right hallux (left) and left hallux (right) in the transverse plane abduction. One can appreciate the slight valgus rotation of the right hallux.



Figure 4 Weight-bearing clinical photo for frontal plane evaluation. Note the right hallux (left) has a slight valgus rotation to it compared to the normal left hallux (right).



Figure 2 Initial presentation of injury. Notice slight valgus rotation and abduction to the right foot hallux (left) compared to the left foot (right) on weightbearing.

The patient related no history of bunion deformity or rotation to the toe prior to the injury and the contralateral limb demonstrated normal first ray alignment. Clinically, the hallux was noted to be in a slight valgus rotated position in the frontal plane, exaggerated upon weightbearing (Figures 3-4). A very mild abduction of the hallux was appreciated. Mild hypermobility of the first ray was noted bilaterally in equal amounts. Sensorimotor function of the foot was intact. Instability on stress was not noted. Muscle inventory to the joint was within normal limits in dorsiflexion, plantarflexion, abduction, and adduction. The extensor hallucis longus was palpable to its insertion. The radiographs taken immediately after the injury were negative for fracture to the metatarsal, phalanx, or sesamoids.

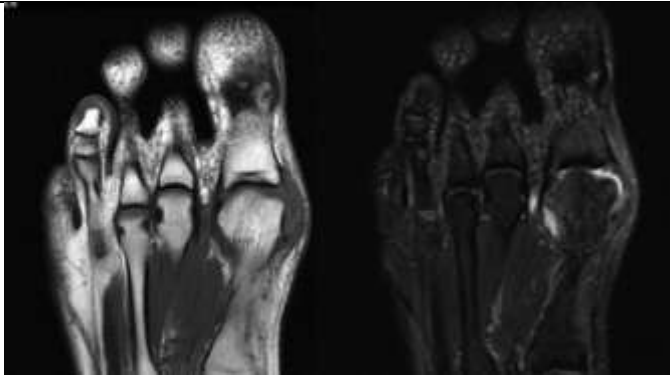


Figure 5 MRI slice T1-Axial (left) and T2-Axial (right) that demonstrates the medial first MTPJ capsuloligamentous tear with discontinuity of the dark capsuloligamentous structures and edema noted on the T2 (right). The lateral capsuloligamentous structures are intact (dark band from lateral proximal phalanx base to metatarsal head) for side comparison on both images.

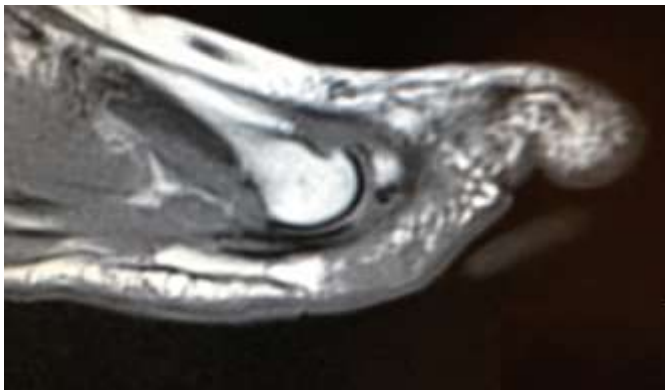


Figure 6 MRI slice (T1, Sagittal) that demonstrates a second MTPJ plantar plate tear. Notice the discontinuity in the dark ligamentous structures along the plantar metatarsal head and base of proximal phalanx where the distal attachment lies.

No malalignment of valgus rotation to the metatarsal, hallux abductus interphalangeus, abduction of the hallux was apparent but these films were limited in being non-weightbearing (Figure 1). An MRI was ordered with suspicion of bone marrow edema or capsular tear and subsequently revealed capsuloligamentous tear to the medial first MTPJ (Figures 5-6). With the diagnosis of MCL/capsule tear made, the patient was sent to physical therapy for six weeks. The hope was to strengthen the ligaments and muscles around the first MTPJ to help correct the position. Over the course of therapy and splinting, little gains were made in correcting the position of the toe. Despite an improvement in pain as the ligaments healed, no improvement to position was noted as the

hallux appeared virtually unchanged since the initial presentation

Discussion

The anatomy of the first MTPJ is more complex than the lesser toes, consisting of seven muscles, eight ligaments, and two sesamoids [4]. On either side of the metatarsal head lies the collateral (metatarso-phalangeal) and sesamoid (suspensory) ligaments (Figures 7-8). The collateral ligaments, originating from the medial and lateral metatarsal epicondyle, run distal-plantar towards the insertion at the base of the proximal phalanx while the sesamoid ligament with the same origin, runs more directly plantar to attach to the margin of the sesamoid and plantar plate beneath the metatarsal head [1,7]. Injury to these specific medial ligaments resulting in hallux valgus has only been described six times, first by Douglas et al in 1997, occurring in a professional soccer athlete. Of the remaining five etiologies, injuries were attributed to other soccer injuries, track sprinter injury, the foot being rolled over by truck, and a fall from height [3,6-8]. Each incident had a varying mechanism that caused the injury and therefore pinpointing a common source in order to help prevent recurrence is difficult. However, Coker et al has described three principle mechanisms in acute MTPJ injuries: hyperextension of the joint inducing a lesion of the joint capsule and plantar plate (most common), hyperflexion injury, and valgus force from sudden acceleration [16]. The last mechanism describes this case.

The physical exam should consist of a biomechanical exam of the first ray. Assess the range of motion of the joint, whether the deformity is reducible, position with or without weightbearing, and any laxity in the capsule on stress exam [9]. Perform a valgus stress test to the joint in attempt to reproduce the medial pain or demonstrate a joint laxity. This can also be done under fluoroscopy to assess lateral shift of the proximal phalanx versus the contralateral side [8]. Additionally, due to the patient presenting secondary to a trauma to the foot, assess for any acute edema, ecchymosis, or tender areas to palpation. It is important to evaluate the Lisfranc ligament in addition as injury to this area has been cited to cause a post traumatic hallux valgus [4].

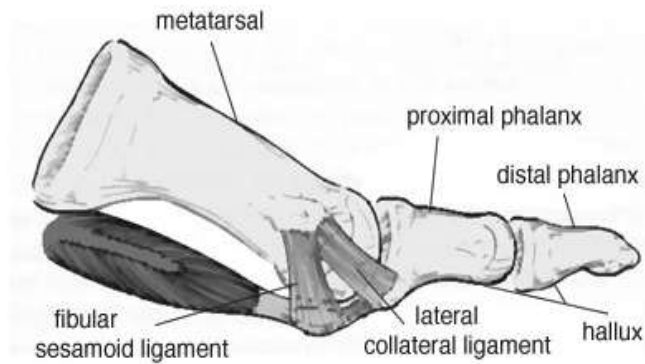


Figure 7 Sagittal anatomic visualization of the collateral (metatarsophalangeal) and sesamoid (suspensory) ligaments. Reproduced with permission from Northcoast Footcare [14].



Figure 8 Axial anatomic visualization of the soft tissue anatomy of the first MTPJ. Reproduced with permission of Waldrop et al [15].

Further exam points should consist of questioning the patient of any feeling of instability on weightbearing, any previous treatments such as steroid injections, or any recollection of toe deviation (hallux valgus) to a lesser degree prior to the trauma [8].

Radiographs are often the first imaging modality used. As in any trauma situation, initial evaluation should consist of assessing the osseous structures for fracture and the alignment of joints/articulations, abnormalities suggesting ligamentous injury.

Arthrogram techniques can help further demonstrate any ligamentous tears [8]. High resolution musculoskeletal ultrasound (MSK US) has also been discussed as an initial imaging modality [6]. Magnetic resonance imaging (MRI) or computed tomogram (CT) can be added to assess soft tissue structures or any intra-articular pathology [3]. The collateral ligaments are typically a thin, linear, low-signal intensity structure. With injury one can see MCL thickening and increased signal intensity on MRI T2 or STIR images, best visualized on axial or coronal views, suggestive of sprain. Further, a discontinuity along the capsule or ligaments path suggested tear [3]. This injury has been stated to be best seen on fat-suppressed sequences [3]. For MSK US evaluation, ligaments normally appear hyperechoic (lighter) with uniform thickness and signal. When pathology exists, ligaments demonstrate a hypoechoic (darker) thickening if partially torn or have a hypoechoic gap with heterogenic pattern due to hemorrhage if acutely and completely torn. Chronically torn ligaments remain thickened and on dynamic US evaluation show a laxity in their structure [10,11]. Remember that this technique is highly operator dependent for accurate diagnosis.

In many of the reported cases like the one presented here, the diagnosis of post traumatic hallux valgus was not made at the initial presentation, regardless if the patient was seen immediately or several weeks after the injury. In each of the reported incidents of this injury, the presentation of an acute trauma, medial tenderness, swelling, and ecchymosis were consistent findings. It was not until months later in follow-up after the patient was first evaluated that the hallux valgus was diagnosed. Patients commonly subjectively stated they had noticed a lateral drifting or rotation of the toe and instability in gait after the injury [6,7]. This point is important to remember when evaluating first MTPJ pain that has a specific medial symptomatic component, especially in the immediate timeframe post injury. Index of suspicion should be high for medial capsuloligamentous injury. Treating a medial capsuloligamentous injury should consist of oral anti-inflammatory and immediate institution of short term (4-6 weeks) bracing to allow the medial soft tissue to heal in a rectus and not attenuated position. Bracing can consist of either a hallux valgus splint or hand-moldable silicone putty appliance for the first interspace. Taping techniques to prevent

hallux valgus can also be implemented. A walking fracture boot can also be implemented for additional stabilization or offloading while added institution of non-weight bearing (NWB) can further protect the joint and stresses that weight-bearing adds. Injection therapy should not be attempted as these could weaken then ligaments further [8]. Even if there is no true initial tear and the injury is a mild sprain, daily activities such as walking could secondarily result in further soft tissue deformity, stressing the importance of maintaining proper alignment and consideration for NWB in acute presentation [6]. Literature has not cited the need for immediate surgical intervention in this deformity even if diagnosed acutely [3,6]. It is important to follow a traumatic hallux valgus patient closely with serial physical exams and radiographs to assess progressive deformity [9].

The authors were not able to find a specific therapy regimen for capsuloligamentous tears to the first MTPJ. There is an abundant amount of literature regarding rehabilitation for first MTP joint injuries and plantar plate, turf toe related injuries that could be called upon in treating and rehabbing a lateral capsule tear. These injuries all share the common goal in initial edema control and decreasing pain to performing exercises to help strengthen the ligaments and muscles around the joint and use of modalities to break up scar tissue [12].

When indicated, surgical treatment should consist of addressing the primary etiology. This is often based on the mechanism of injury, whether strictly soft tissue or osseous trauma resulted in deformity. Medial collateral direct repair and reefing or plication of the medial joint capsule is often a main component of any repair [6,7,13]. Correction of an underlying hallux valgus may be beneficial to decrease potential post-operation stress and degeneration to the medial soft tissue repair [8]. Evaluation of the joint should also be performed for any intra-articular pathology, especially in the setting of significant pain with mild deformity. First MTPJ pain has been reported in 43.8% of patients with non-traumatic hallux valgus and this figure is assumed to be much higher in the traumatic setting [3]. To relieve joint pain, potential interventions can include arthroscopy, loose body removal, synovectomy, osteochondral lesion excision with microfracture, decompression osteotomies, or subchondroplasty [3]. Choice of surgery should be

based on patient functional level with soft tissue procedures on athletes and add osseous procedures to the average functioning patient [8].

Here, the valgus rotation of the toe was not seen until 8 weeks after the injury, being missed on initial evaluation in the emergency room post-accident. At the first visit to our office, splinting was instituted to prevent further deformity. Although we could not prevent the hallux valgus (as it was an immediate consequence of the injury), little progression was noted across the months of follow-up. Physical therapy was attempted for six weeks, but ultimately no healing of the medial ligamentous in a more native position occurred and the patient desired surgical correction at a later point in time.

Conclusion

In reviewing these injuries, one should first off have an understanding of the anatomy about the first MTPJ to appreciate what capsuloligamentous or tendon structures might be damaged to create the presenting deformity. Secondary, the clinician should hone in on the suspected anatomic location of insufficiency in evaluating studies like radiographs, MSK US, or MRI. In radiographs, one should evaluate for any fractures or bony avulsions, insinuating potential ligamentous damage, while on MSK US or MRI looking for discontinuity of capsuloligamentous structures around the MTPJ. This disruption is akin to evaluating for a MTPJ plantar plate tear, attempting to identify a break in the low intensity (T1 and T2) capsule. On MSK US, hypoechoic signal with or without a discontinuation (representing a tear) along with heterogenous hemorrhage signal are common ligament or capsular tear findings.

With acute injuries to the first MTPJ that have negative osseous trauma, one should still perform a thorough soft tissue evaluation and assess the areas of maximal tenderness with any concomitant erythema, edema, or ecchymosis. If there are positive findings of medial joint pain, the clinician should suspect medial soft tissue damage and should be treated like any sprain with the appropriate bracing and subsequent physical therapy. Care should be taken to protect the medial structures during the healing process to prevent long term deformity. This can be

accomplished by hallux valgus taping techniques or pre-made splints, spacer in the first interspace, or CAM boot. If deformity does occur with biomechanical insufficiencies and pain, surgery can be offered in an attempt to realign the first ray and decrease pain to the joint.

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