Fifth Metatarsal Fractures

OVERVIEW

The fifth metatarsal is the most common metatarsal fractured. The metatarsals are the most important weight bearing structure in the forefoot. Complex relationships between the metatarsals exist, and they work in conjunction, for ideal biomechanical foot function. The fifth metatarsal has a unique blood supply and biomechanical function that lend it to more complex considerations for fracture management than the other lesser metatarsals.

ANATOMY

The fifth metatarsal has less soft tissue coverage and intrinsic muscle attachments than the lesser metatarsals. It has an important function in maintaining the tripod effect of the foot with the calcaneus and first metatarsal. The fifth metatarsal is the most mobile of the metatarsals. It has extrinsic muscle attachments including the peroneus brevis, tertius, and lateral band of plantar fascia. The blood supply of the fifth metatarsal is an important determinant in treatment algorithms. The fifth metatarsal is supplied by arterial branches from the dorsalis pedis, posterior tibial and peroneal arteries. The nutrient artery arises from the fourth plantar metatarsal artery and inserts into the plantar medial diaphysis of the metatarsal in approximately 80% of individuals. The metadiaphyseal region of the fifth metatarsal is vulnerable to increased nonunion rates due to the anatomic location of the bloody supply which results in this watershed zone.

BIOMECHANICS

The fifth metatarsal, as stated above, has the most motion through the TMT articulation when compared to the first through fourth. The 5th TMT articulation is important to the accommodative function of the lateral column. The increased motion through the 5th TMT articulation allows the accommodative nature of foot position during the gate cycle in order for the foot to function optimally. If there are significant alterations to the position of the metatarsal heads due to fractures and trauma, forefoot metatarsalgia can result.

PATHOGENESIS

Fifth metatarsal fractures result from a variety of low and high energy mechanisms. Low energy mechanisms include a stress response, and twisting injuries of the forefoot. High energy trauma includes lawn mower injuries, industrial accidents, and motor vehicle accidents. There are 2 eponyms that are commonly used to describe fifth metatarsal fractures: dancers and Jones fractures. Dancer's fractures typically occur with inversion injuries and involve the shaft of the metatarsal. Fractures in this location typically heal well treated non-operatively. Jones fractures are the subject of much debate and there is sometimes confusion as to what anatomic location this refers to in the metatarsal. Fractures in the region of the meta-diaphyseal region are referred to Jones fractures; this is a relatively avascular zone which increases the rates of nonunion. Stress fractures more commonly occur in this metadiaphyseal region as well. Metatarsal base fractures typically occur in the cancellous region of the MT base, and likely occur due to an inversion strain of the lateral plantar aponeurosis. Metatarsal base fractures, when minimally displaced, heal well treated non-operatively.

CLINICAL PRESENTATION

Patients presenting with stress related injuries, typically describe a prodrome of pain that has been present from weeks to months prior to either fracture completion or presentation to the clinician's office. Other common injury presentations include a forced abduction force of the forefoot with ankle planarflexion. Many acute Jones' fractures occur in athletes. This has important implications in treatment and length of immobilization.

EXAM

Fifth metatarsal fractures arise in patients of all ages. Most injuries are closed but the high energy and lawn mower injuries can present with open fractures. Metatarsal fractures present with dorsal soft tissue swelling and ecchymosis and pain with weight bearing. When patients present with high energy mechanisms, the examiner should pay close attention to the neurovascular exam and both the TMT and MTP articulations. As with all disorders of the foot and ankle, a thorough examination is performed including inspection, palpation, ROM, sensory and vascular exams. If patient is able, a gait analysis and position of the lower extremities

should also be performed with the patient weight bearing. Examiners should pay close attention to the TMT articulations particularly to assess for Lisfranc injuries.

STAGES

There is not a formal classification system for metatarsal head, neck and shaft fractures. These fracture locations tend to heal well with conservative treatments. There is a zone classification of proximal metatarsal fractures. Zone 1 involves the fifth metatarsal tuberosity. Zone 2 involves the proximal metaphyseal-diaphyseal junction without distal extension beyond the fourth and fifth intermetatarsal articulation or the acute Jones fractures. Zone 3 described diaphyseal fractures or the classic "dancer's fractures".

IMAGING STUDIES

Plain radiographs are the mainstay of imaging modalities for fifth metatarsal fractures. If the patient is able, weightbearing: AP,Oblique, and lateral views are preferred. The examiner is looking for any displacement, shortening, and angulation in any plane. Close attention to the anatomic location of the proximal fractures guides treatment algorithms. Examiners should also evaluate the lateral metatarsal for thickening indicative of a healing stress response or fracture.

TREATMENT

For most metatarsal head, neck and shaft fractures, conservative treatment is the treatment of choice. Typically non-operative treatment in a cast or CAM boot for 6 weeks is indicated. These fractures take longer to heal radiographically, but as long as there is progression of healing and minimal pain it is common to advance the patient into a regular shoe at the 6 week mark from the injury. Surgery is indicated for non-unions and significant fracture displacement but is uncommon in this anatomic location. Almost all avulsion tuberosity fractures heal well treated non-operatively in a cast or CAM boot with weight bearing as tolerated for 8 weeks. For acute Jones fractures the treatment of choice is still non-operative unless there is a stress fracture prodrome and injury occurs in an elite athlete. Non operative treatment in a cast, with non weightbearing status for 6-8 weeks and then transition into a CAM boot is recommended. If there is persistent pain after at least 3 months of conservative treatment operative intervention is considered. Operative intervention in the form of an intramedullary solid screw is the treatment of choice. For fractures with a prodrome and

stress response changes radiographically, most surgeons advocate for operative intervention. There is some debate whether to open the fracture site and bone graft for acute stress injuries. Many surgeons feel that reaming the fracture site with a drill is enough to stimulate union, in addition to placement of the intramedually screw. Finally, in elite athletes who wish to avoid the prolonged immobilization with conservative treatment, operative intervention is often the treatment of choice.

CONCLUSION

Fifth metatarsal fractures require careful evaluation and treatment. The fifth ray is integral to the function of the forefoot and biomechanics of the tripod foot. The inherent blood supply and anatomy of the fifth metatarsal guide treatment algorithms. It is imperative for the treating physician to understand the complexities involved when treating fifth metatarsal fractures.

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