Base of the Fifth Metatarsal Fractures

OVERVIEW

Base of the fifth metatarsal fractures are those occurring between the tuberosity and proximal diaphysis. The fracture patterns observed here reflect the local anatomy and biomechanics. Three groups of fractures can be arranged based on their location, injury mechanism, and timing of injury. Treatment considerations include clinical and radiographic factors.

ANATOMY

The base of the fifth metatarsal is comprised from proximal to distal by the tuberosity, metaphysis, and proximal diaphysis. The tuberosity is largely covered by the peroneus brevis tendon insertion but also features a plantar process for the insertion of the lateral band of the plantar aponeurosis and a facet for articulation with the cuboid. The metaphysis is distal to the tuberosity and is bound to the proximal fourth metatarsal metaphysis through relatively strong dorsal and plantar intermetatarsal ligaments. The metaphysis also features a medial facet for articulation with the fourth metatarsal. The proximal diaphysis extends 1.5 cm distal to the metaphysis. Whereas ample blood flow reaches the tuberosity (through abundant) metaphyseal-epiphyseal vessels) and prosimal diaphysis (through nutrient artery system), a relatively hypovascular zone exists between these systems in the region of the metaphysis.

BIOMECHANICS

Relatively strong dorsal and plantar intermetatarsal ligaments stabilize the articulation between the proximal fourth and fifth metatarsals. This complex resists displacement by tensile forces acting through the attachments on the tuberosity and by axial, rotational, and adduction forces acting through the diaphysis.

PATHOGENESIS

Fractures occur within three distinct zones of the base of the fifth metatarsal.

Zone 1: Tuberosity avulsion fractures result from forces exerted through the peroneus brevis tendon and lateral cord of the plantar fascia. These fractures may extend into the fifth metatarsocuboid joint.
Zone 2: Acute Jones fractures were first correctly described by Sir Robert Jones in 1902 and extend from the distal tuberosity into the articulation with the fourth metatarsal. Rapid loading of the lateral foot with a relative adduction of the distal 5th MT produces acute fractures within or at the distal margin of the intermetatarsal ligament complex.
Zone 3: Diaphyseal stress fractures occur distal to the intermetatarsal ligaments and may extend distally 1.5cm into the tubular portion of the bone. These fractures result from repetitive loading with axial, rotational, and adduction forces acting through the diaphysis at sub-failure loads. These forces are resisted by the proximal intermetatarsal ligament complex resulting in stress concentration in the proximal diaphysis.

CLINICAL PRESENTATION

Patients with acute fractures report an event with rapid loading on the lateral border of the midfoot causing the sudden onset of pain and swelling localized to the proximal fifth metatarsal. This may now limit their ability to bear weight. In contrast, patients with acute on chronic fractures, particularly of Zones 2 and 3, often report prodromal weight bearing-associated pain along the lateral border of the midfoot with an acute increase in pain corresponding the development of the fracture.

EXAM

Swelling, ecchymosis, and point tenderness may be present along the dorsolateral midfoot. This pain may be exacerbated directly by manipulation of the fifth metatarsal and indirectly by recreation of the position of the foot at the time of injury. Uncommonly, a displaced tuberosity fracture may palpable as a subcuticular prominence.

STAGES

Zone 1 and 2 injuries are most commonly are acute fractures. Delayed unions and nonunions are more likely to occur in the relatively hypovascular region corresponding to Zone 2. Zone 3

fractures are most commonly stress fractures occurring as a continuum from stress response without fracture to fracture nonunion.

IMAGING STUDIES

Weight-bearing AP, Lateral, and Oblique views of the involved foot are used to identify either the presence of fracture or periosteal/endosteal reaction in the proximal fifth metatarsal. When interpreting radiographs, it is useful to know that fractures tend to propagate from lateral to medial but healing tends to progress in the opposite direction.

The Torg classification of Zone 3 fractures describes a spectrum of radiographic findings ranging from acute fracture (sharply marginated fracture line with minimal reactive bone) to delayed union (fracture through medial/lateral cortices with resorption at fracture site, reactive periosteal new bone, and canal sclerosis) to nonunion (widened fracture with resorption, periosteal reaction, and canal obliteration).

Non-contrast enhanced MRI may be needed to identify an early stress response in Zone 3 injuries when radiographs are nondiagnostic.

TREATMENT

Zone 1 fractures tend to heal well. Initial symptomatic care consists of rest, ice, elevation, oral NSAIDs. Weight bearing to tolerance is permitted in a hard-sole shoe or short leg walking cast for four to six weeks. Pain resolution precedes radiographic healing. Open reduction and internal fixation with a compression screw is reserved for intraarticular displacement involving the metatarsocuboid joint or displaced, malrotated proximal fracture fragments. Zone 2 and 3 fractures are at increased risk of delayed or nonunion. In addition to initial symptomatic care, nonoperative management consists of nonweight bearing in a short leg cast or cast boot for 6 to 8 weeks. Open reduction and internal fixation with an intramedullary compression screw and possibly bone grafting is an option for patients with inadequate radiographic signs of healing after 6 weeks or for those patients who wish to expedite return to physical activity. Surgery is typically recommended in elite athletes who present with this fracture.

CONCLUSION

When base of the fifth metatarsal fractures are suspected, careful assessment of the patient's history, physical exam, and radiographic findings permits accurate diagnosis and appropriate management.

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