39 Metatarsal fractures - 1st and 5th

Contents

- Introduction
- Anatomy
- Classification
- Clinical Presentation
- Imaging
- Treatment
- Complications

39.1 Introduction

Metatarsal fractures are common. Because the five metatarsals function differently, they each require different treatments. The metatarsals are divided into three sections:

- 1st
- 5th
- 2nd through 4th

The most common mechanisms of injury are either direct impact, such as a crushing injury causing a transverse or comminuted fracture pattern, or a twisting-type injury causing an oblique fracture pattern with soft-tissue swelling. Chronic direct forces can produce stress fractures. Avulsion may occur, especially at the base of the 5th metatarsal.

39.2 Anatomy

The 1st metatarsal is wider, shorter, stronger, and more mobile than the others. Two sesamoid bones under the head of the 1st metatarsal bear approximately one third of the body weight. The anterior tibialis attaches to the inferomedial base, functioning in elevation of the 1st metatarsal and supination of the forefoot. Peroneous longus attaches on the proximal lateral base, functioning in plantar flexion of the first metatarsal and pronation of the forefoot. There are no interconnecting ligaments between the 1st and 2nd metatarsals, allowing for independent motion. Injuries to the 1st metatarsal are usually due to direct trauma and are often open or comminuted. The dorsalis pedis artery and deep peroneal nerve are in this area, and branches of the superficial peroneal nerve are around the deeper structures and must be protected during surgery.
The 5th metatarsal has the tendinous attachments of the peroneus brevis and tertius and is a point of the attachment of the plantar aponeurosis. Fractures of the 5th metatarsal account for approximately 25% of all injuries to the metatarsals, including basilar or avulsion fractures, metadiaphyseal (Jones) fractures, metadiaphyseal stress fractures, and diaphyseal fractures. Blood is primarily supplied from a single artery that enters at the junction of the proximal and middle thirds of the diaphysis and supplies the shaft. Secondary arteries supply the base and the tuberosity. Damage to the sural nerve, which is also present in the surgical area, should be avoided.

### 39.3 Classification

The Orthopedic Trauma Association uses the format [81( ) - _ _._] to classify metatarsal fractures. The parenthesis holds a letter corresponding to a metatarsal as follows:

- T = 1st metatarsal
- N = 2nd metatarsal
- M = 3rd metatarsal
- R = 4th metatarsal
- L = 5th metatarsal

The first blank holds a letter corresponding to fracture complexity:

- A = Extra-articular and simple diaphyseal wedge fracture
- B = Partial articular and diaphyseal wedge fracture
- C = Complex articular or diaphyseal fracture

The second blank holds a number indicating the involved area:

- 1 = Proximal metaphyseal
- 2 = Diaphyseal
- 3 = Distal metaphyseal

The third and fourth blanks hold numbers that indicate fracture patterns and they vary depending on the group and the first number.

The proximal 5th metatarsal is divided into 3 zones based on location of the fracture:

- Zone 1: The base of the 5th metatarsal; commonly see avulsion fractures
- Zone 2: Fracture of the proximal metaphyseal-diaphyseal junction, also called a Jones fracture; results from adduction or inversion of the forefoot
- Zone 3: Proximal diaphyseal stress fractures

### 39.4 Clinical Presentation
Patients present with pain, dorsal swelling, and tenderness over the fracture site. Assessment of each metatarsal can be performed by palpating the shaft, tarsometatarsal (TMT) joint, and the plantar metatarsal heads to evaluate for elevation of the head. It is important to maintain good alignment of the metatarsophalangeal (MP) joint. Assessment of neurovascular status should be performed. Anteroposterior (AP) and lateral weight-bearing X-rays should be obtained. Technetium bone scan or MRI can assist in diagnosis of occult stress fractures.

### 39.5 Imaging

Other associated injuries to the foot may also be present; therefore, initial X-rays should include the whole foot.

### 39.6 Treatment

For the 1st metatarsal, a stress X-ray may help determine whether treatment should be operative or nonoperative. With proximal metatarsal fractures, injury to the proximal ligaments (Lisfranc injury) should be excluded. A shaft fracture with acceptable alignment should be treated with heel touchdown weight-bearing. Nondisplaced or minimally displaced fractures can be treated with a short leg cast or removable boot with minimal weight-bearing over 4 weeks. Active and passive motion exercises are helpful. Operative treatment is indicated if there is any evidence of instability or loss of normal position of the metatarsal head. Choice of operative treatment depends on the configuration of the fracture. Options include closed reduction with percutaneous K-wire fixation or ORIF. Severely comminuted fractures which are unable to be fixed with lag screws may be treated with external fixation.

Treatment of the 5th metatarsal depends on the zone of injury.

- **Zone 1 injuries and distal fractures** can be treated closed unless significant articular step off, then open reduction and internal fixation (ORIF) should be considered.
- Treatment of **acute injuries of Zone 2**, the proximal diaphysis, is controversial and can range from short leg casting to surgery. Zone 3 injuries distal to the proximal tuberosity require more aggressive treatment.
- **Zone 3 injuries** have a higher incidence of nonunion. Non-weight-bearing and casting are effective in some cases. Surgery should be reserved for nonunion or athletes who need quicker return to sport. Differentiation should be made from a chronic stress fracture often associated with a cavus foot.

### 39.7 Complications

Possible complications of injury and treatment of the 1st metatarsal include malunion, nonunion, arthritic degeneration of the TMT and MP joints. If shortening of the 1st metatarsal occurs, transfer metatarsalgia can occur in the other toes. A second surgery may be necessary to realign or bone graft the fracture.
Complications are rare in 5th metatarsal injuries and treatment. In Zone 1 fractures, asymptomatic nonunion can occur, but this usually does not require intervention. Sural nerve entrapment can occur. Although not commonly recognized, displaced intra-articular fractures can result in a chronically painful joint. Tarsometatarsal joint pain can occur with nonunion. Nonunion of Zones 2 and 3 are due to inadequate treatment, poor blood supply, and cavus alignment of the foot, placing stress on the 5th metatarsal. Failure of operative treatment is due to resumption of activity too early, poor compression at the fracture site, inadequate bone grafting, or incomplete debridement of the sclerotic medullary canal.