FIFTH METATARSAL FRACTURES

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Fractures of the fifth metatarsal account for 6% of podiatric emergency room visits. This figure accounts for approximately 19% of all fractures and 82% of metatarsal fractures. These numbers are based on an evaluation of 750 podiatric emergency room visits over the course of one year at Northlake Regional Medical Center in Tucker Georgia. Further analysis of the data showed a bimodal distribution of the incidence of fractures, with females being twice as common as men to sustain this injury.

Fifth metatarsal fractures are of particular interest and importance due to the fact that the fifth ray exhibits an independent range of motion as compared to the central three rays. This factor, in combination with the natural tendency for the distal portion of these fractures to displace dorsally, commonly leads to a significantly dorsiflexed fifth ray if it is allowed to heal without either open reduction with internal fixation (ORIF) or good external splintage. In practice, external splintage is usually difficult to achieve and maintain. This difficulty is due to the fracture orientation which has a tendency to allow shortening and dorsiflexion, even without the superimposed forces of weight bearing. It should be mentioned at this point however, that transverse fractures are obviously more stable and may be more amenable to closed treatment than the distal spiral oblique variety. Elevation and shortening may lead to changes in the distribution of weight bearing and possibly cause transfer lesions under the central metatarsals.

Fifth metatarsal fractures can generally be divided into three different groups. These groups are distal, spiral oblique fractures; transverse fractures of the diaphyseal metaphyseal junction proximally as described by Jones in 1902; and the proximal avulsion fracture of the tuberosity of the metatarsal. Rational for operative intervention should then be based on the intrinsic stability of the fracture, as well as the potential for mal-union or non-union.

DISTAL SPIRAL OBLIQUE FRACTURES

The distal spiral oblique fracture of the fifth metatarsal is commonly encountered with an inversion type mechanism often involving a step down from a curb or other short distance. The fracture orientation most commonly observed in our limited population ran from distal plantar lateral to dorsal proximal medial. It was not uncommon to see some degree of comminution in these fractures. The typical patterns encountered include the simple two fragment case (proximal and distal fragments), two main fragments with an associated butterfly fragment, and a case with significant comminution.

The faculty at the Podiatry Institute recommends ORIF for this type of fracture in the healthy patient. ORIF allows a normal weight distribution to be maintained, and more importantly prevents bone healing complications such as malunion, delayed union or non-union. ORIF allows for the prevention of axial shortening which occurs in the closed treated case due to longitudinal and sagittal plane instability.

Adequate reduction may be difficult to achieve without complete exposure of the proxi-

mal and distal extent of the fracture. Therefore, the need for complete visualization of the fracture line to aid in reduction and fixation should be emphasized. Once the exposure has been achieved, distal traction is the key for reduction of the fracture and elimination of any shortening which may have occurred prior to fixation. Visualization is aided by copious irrigation and curettage of the fracture site to remove any hematoma. Caution should be exercised to identify and protect any small butterfly fragments while this is being performed

Following reduction, fixation is commonly achieved with the use of two or three 2 mm AO cortical bone screws. In cases with extensive comminution, cerclage wiring may also be helpful. Other options which have been used include a lateral buttress plate in cases with comminution and maxillofacial screws to minimize screw head prominence. The surgeon should be cautious of mixing fixation systems to avoid potential corrosion.

JONES FRACTURES

The Jones fracture, described by Sir Robert Jones in 1902, is a fracture occurring at approximately 1.5 cm distal to the base of the fifth metatarsal. This fracture is of particular interest because of its high propensity to proceed to delayed or non union with conservative therapy. Speculation as to the cause of this increased incidence has most often been credited to motion at the fracture site and a tenuous blood supply to this area of the bone.

The mechanism of this type of fifth metatarsal fracture seems to be a variety of stress fracture. Delee notes that a large percentage of patients related a history of a prodromal period during which there was some discomfort prior to the acute episode which caused the patient to seek medical attention. These fractures also seem to be associated with repetitive forefoot, high stress activities such as basketball and football, which involve heavy loading of the foot in the plantarflexed orientation. Roca et al. showed that the stresses were maximized in testing of fifth metatarsal models at a 50° orientation to the weight-bearing surface, with activity of the peroneus brevis tendon.

Torg reviewed a number of cases of this type of fracture in 1984 and found that the treatment of choice consisted of non-weight bearing in a short leg cast as compared to various degrees of external stabilization and weight bearing. The exception to this recommendation was in the competitive athlete where primary ORIF was recommended. For the delayed or non-union, curettage of the fracture site and packing with autogenous bone graft was recommended. The fracture site was then stabilized with a lateral plate.

Prognosis of the Jones fracture is improved if there is no medullary sclerosis noted on plain film radiographs. A bone scan with a central cold area at the level of the fracture may also correlate with a poor prognosis for conservative therapy. Primary plating of the fracture in the very active individual shows good results with a much lower incidence of non-union. An alternative to this method is the use of a malleolar screw placed intramedullary across the fracture site. The intramedullary screw technique is performed using a 4.5 mm malleolar screw with minimal exposure of the fracture site. Caution must be taken if this method is chosen, to assure that all threads are placed distal to the fracture site.

Other surgical options for treatment of the Jones fracture include a sliding cortical window graft, the use of a mini external fixator applied under fluoroscopic guidance, stabilization with crossed Kirschner wires, or a 90° boxed loop wiring. Also a dorsal to plantar trephine, using either autogenous or allogeneic bone graft, may be employed for treatment of this type of fracture.

AVULSION FRACTURES

Avulsion fractures of the fifth metatarsal base, with the fracture line oriented perpendicular to the longitudinal axis of the bone, are a fairly common type of fifth ray injury. These injuries account for 51% of the fifth metatarsal fractures in the study population. This type of fracture is commonly associated with an inversion sprain type of mechanism. The actual forces involved in generating this fracture have been credited by most as a strong contracture of the peroneus brevis while the foot is in a supinated attitude. Richli and Rosenthal, however, stated that the force causing the observed fracture pattern was generated by tension on the lateral band of the plantar aponeurosis.

Treatment of the avulsion fracture of the fifth metatarsal base is usually by closed reduction (where necessary), and casting. When this is unsuccessful, or if the fragment is large or intra-articular, open reduction may be appropriate. The decision to perform ORIF on these cases should be based on a significant degree of displacement or intra-articular involvement of the fifth metatarsal cuboid joint.

Repair of the fifth metatarsal base avulsion may be accomplished with either tension band wiring or screw fixation. Tension band wiring works well for this fracture because of the forces generated at the fifth metatarsal base. Both forms of fixation may require removal after osseous union due to the potential for irritation from shoes at a prominent styloid process.

CLINICAL CASE STUDY

A 55-year-old female presented to the emergency room at Northlake Regional Medical Center with a history of falling down several steps, five days prior to presentation. The patient related pain in the left foot and elbow following the injury. The patient decided to seek medical attention due to continued pain upon weight bearing, and concern on the part of her daughter. Physical examination showed edema and ecchymosis extending from the base of the digits to the lateral retromalleolar space. Examination also revealed pain on palpation of the fifth metatarsal shaft which was accentuated with loading of the fifth metatarsal head. Radiographs revealed a spiral oblique fracture of the fifth metatarsal, which was displaced dorsally and medially. After an explanation of the injury and treatment options, the patient opted for surgical correction.

After appropriate preoperative evaluation and clearance, the patient was taken to surgery. Intra-operatively, a spiral oblique fracture of the fifth metatarsal with a small butterfly fragment was confirmed. (Figure 1) After irrigation and curettage of the hematoma from the fracture site, reduction was attained and temporarily fixated with two 0.045" Kirschner wires. (Figure 2) These wires were then replaced with 2.0 mm cortical bone screws. (Figure 3) The repair was reinforced with an intra-osseous loop wire between the two screws. (Figure 4)

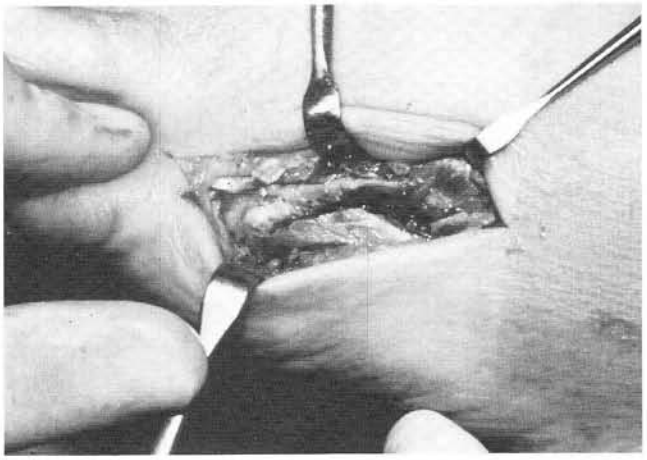

Figure 1. Exposure of the fracture site with distraction shows the proximal and distal extent of the fracture with a small butterfly fragment attached by periosteum dorsally.

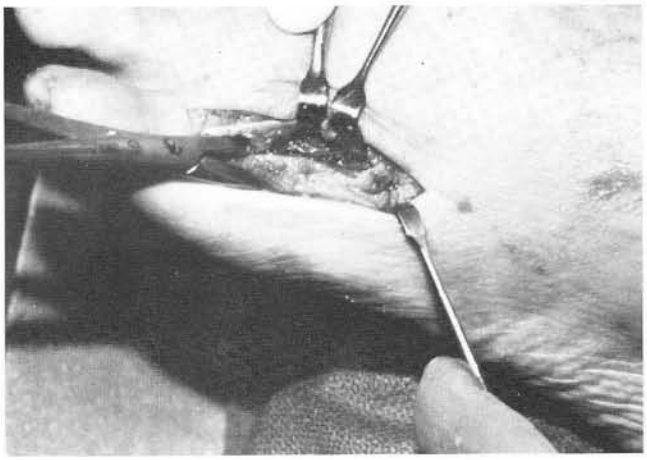

Figure 2. Reduction of the fracture has been achieved with distraction and is maintained with an alligator bone clamp.

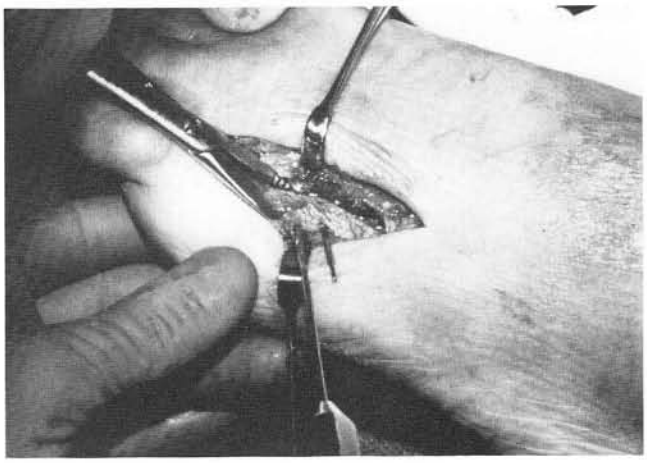

Figure 3. Temporary fixation is achieved with two 0.045" K-wires. Note the distal wire is being replaced with a 2.0 mm cortical bone screw.

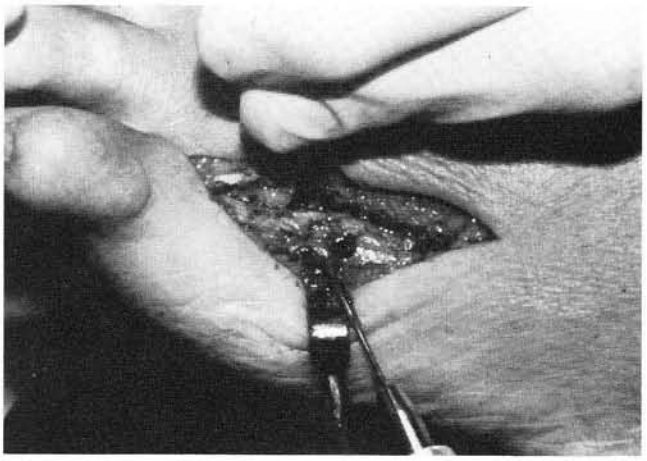

Figure 4. Final inspection prior to closure shows fixation screws and cerclage wiring in place.

Postoperatively, the patient was placed in a modified Jones compression dressing with a protective fiberglass shell and discharged non-weight bearing with a walker. The patient's postoperative course was uneventful and serial radiographs revealed solid union of the fracture site. Ambulation was begun at approximately seven weeks postoperative with unprotected weight bearing ensuing after another two weeks. The patient was discharged after the 14 week postoperative x-rays showed solid union after unprotected weight bearing.

SUMMARY

Common types of fifth metatarsal fractures and their optimal treatments have been reviewed. No matter which treatment method is chosen, emphasis should be placed on maintaining sagittal plane position to prevent an elevated fifth ray, delayed union, malunion or non-union. ORIF in the healthy patient offers an opportunity to achieve anatomic reduction and resist displacement during the healing process.

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