CHAPTER **40**

DISTAL FRACTURES OF THE FIFTH METATARSAL

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Fractures occurring in the shaft and distal portion of the fifth metatarsal are common injuries. A recent review of 1,322 consecutive emergency room visits by patients with foot and ankle injuries showed the following: (1) 76% of all metatarsal fractures occur in the fifth metatarsal; (2) Fractures of the metatarsals account for 19% of all fractures of the foot and ankle; and (3) Diaphyseal and distal neck fractures account for 29% of all fractures of the fifth metatarsal. There are a variety of distal fifth metatarsal fracture subtypes based on anatomic location of the fracture including fractures of the head, isolated neck fractures, and fractures involving the middle or distal metatarsal shaft.

RADIOGRAPHIC EVALUATION

Radiographic evaluation of the injured foot will reveal the location of the fracture and the presence of any articular involvement. After the amount of displacement and angulation of the distal fragment is determined, the sagittal plane position of the distal fragment should be assessed. This is most easily accomplished on the lateral radiograph, with the foot slightly supinated on the plate to minimize superimposition of the metatarsals. An axial view of the metatarsals may also be helpful in determining the amount of sagittal plane displacement of the distal fragment.

Although a moderate amount of transverse plane angulation of the distal fragment is considered acceptable, significant sagittal plane displacement has the potential to cause considerable morbidity if not reduced. Potential complications include sub-fifth metatarsal pain and callus formation as a result of plantar angulation. Whereas transfer lesions, adjacent metatarsalgia or even stress fractures may occur with dorsal malposition of the distal fragment.

Although the position of the distal fragment is somewhat dependent on the direction of the injuring force, most authors report a greater frequency of plantar displacement. The distal fragment is thought to be held in a plantarflexed position due to the strong force exerted by the extrinsic flexors, lumbricals, and interossei, which overpower the extensors. Plantar displacement of the metatarsal head may also occur in forced metatarsophalangeal joint (MTPJ) dorsiflexion injuries, as commonly seen in parachute jumpers.

FRACTURES OF THE FIFTH METATARSAL HEAD

Fractures isolated to the metatarsal head are extremely rare injuries and usually occur secondary to a direct traumatic force such as a falling object striking the foot. Regaining normal anatomic alignment of the fracture fragments often proves difficult, and therefore, some degree of osteoarthritis may be expected to develop. Moderate shortening of the fifth metatarsal may also occur as a result of an impaction fracture of the metatarsal head (Fig. 1).

Figure 1. Impaction fracture of the fifth metatarsal head.

Treatment Recommendations

Fifth metatarsal head fractures are usually treated conservatively due to the significant comminution often present. If significant displacement of the head is present, closed reduction using woven finger traps may be attempted. The patient is typically kept non-weight bearing in a below-knee cast for 4 to 6 weeks. A distal toe plate can be added to the cast for protection. Passive range of motion exercises may be initiated after several weeks to attempt to preserve some joint function.

All non-united intra-articular fragments from the fifth metatarsal head may be excised on a delayed basis, if the patient is symptomatic. Although it is not suggested as a primary treatment, fifth metatarsal head resection may be considered as a long-term salvage procedure where a painful, nonfunctional fifth metatarsal head has resulted after a severe intra-articular fracture.

ISOLATED FRACTURES OF THE FIFTH METATARSAL NECK

Fractures involving the neck of the fifth metatarsal are also uncommon, and along with fractures of the fifth metatarsal head account for only 5% of all fifth metatarsal fractures. Although most distal fifth metatarsal fractures occur as a result of direct trauma, they may also occur from indirect forces such as stepping off a curb with the foot inverted. Isolated neck fractures are most often transverse in orientation. These fractures occur as a result of a bending force produced within the distal portion of the metatarsal from a dorsal to plantar, or plantar to dorsal directed traumatic force.

Treatment Recommendations

Closed reduction techniques using distal traction are normally fairly successful in improving alignment of displaced transverse fractures. Once reduced, the transverse fracture is somewhat stable. Transverse neck fractures may be stabilized with a variety of internal fixation devices if necessary. Techniques may include intra-medullary K-wire fixation, stainless steel cerclage wire, and small "L" or "T" plates. The foot is then protected in a non-weight-bearing below-knee cast for 6 weeks.

There are several methods available to stabilize transverse fractures of the lesser metatarsals using K-wire fixation. Three of the more common techniques will be described.

Technique #1. The fracture is exposed through a small dorsal incision, and any interposed soft tissue or hematoma is removed. While holding the toe in a dorsiflexed position, a K-wire is driven from the base of the distal fragment, through the metatarsal head. The pin is then pulled forward until only a few millimeters of the proximal tip are left exposed in the fracture gap. The fracture is reduced, and the pin is driven across the fracture in a retrograde fashion into the proximal fragment. After the K-wire is in place, the proximal phalanx will "ride high" on the pin (Figs. 2A, 2B).

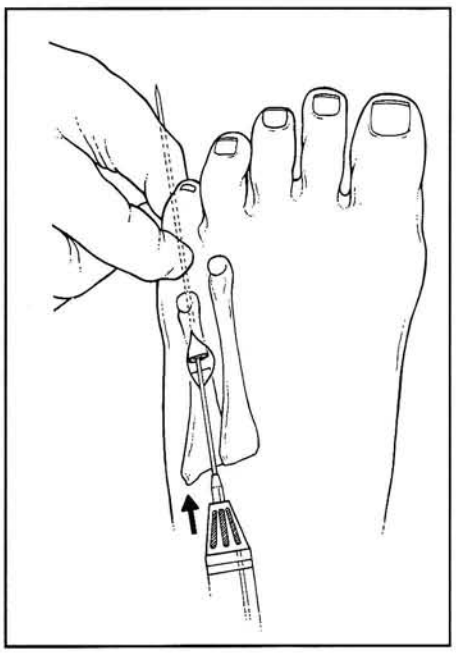

Figure 2A. Fixation of a fifth metatarsal fracture through a small dorsal incision.

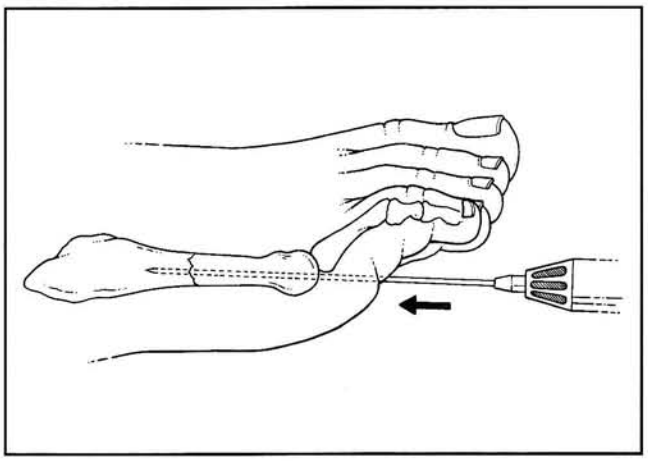

Figure 2B. The proximal phalanx is left "riding high" on the pin.

Postoperative stiffness and a slowly-resolving dorsal contracture at the MTPJ may be occasional complications that result from leaving the toe in a dorsiflexed position for several weeks.

If the fracture is in good alignment after closed reduction, another option for pin placement is to percutaneously drive the wire into the metatarsal head and across the fracture site. The wire may be driven "blindly," or under fluoroscopic visualization.

Technique #2. A limited dorsal exposure over the fracture site is performed as described in Technique #1. The K-wire is then driven across the MTPJ, with the digit in a neutral position. Inserting the pin in this manner results in the wire exiting the plantar surface of the proximal phalanx, and therefore the toe is not maintained in excessive dorsiflexion. The wire is retrograded across the fracture, and cut distally, approximately 1 cm from the skin surface (Figs. 3A, 3B).

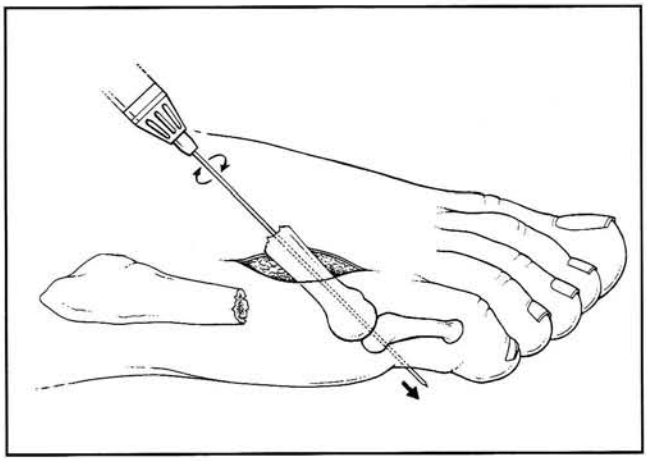

Figure 3A. Fixation of a fifth metatarsal fracture with the pin across the phalangeal base.

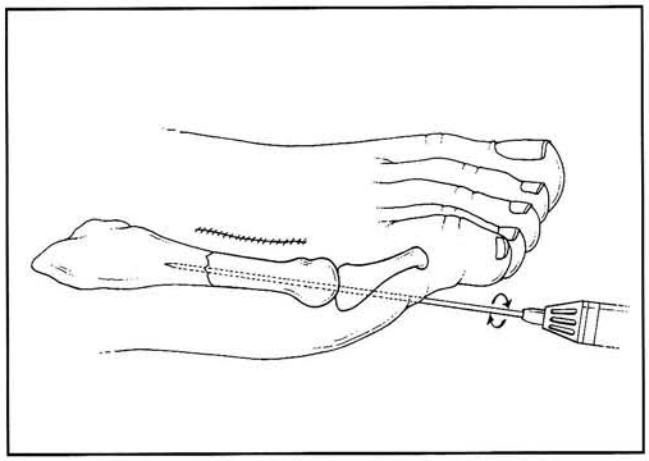

Figure 3B. The toe is kept in neutral dorsiflexion.

Technique #3. If the surgeon prefers not to leave the pin protruding from the skin, a technique advocated by Lindholm may be considered. In this technique the fracture is exposed from a dorsal approach and a K-wire is driven into the proximal fragment. The pin is then cut approximately 1 cm beyond the end of the proximal fragment. The distal fragment is placed on the pin and the fracture site is aligned (Figs. 4A, 4B). When this technique is used, the fixation is not left exposed, and the K-wire does not cross the MTPJ.

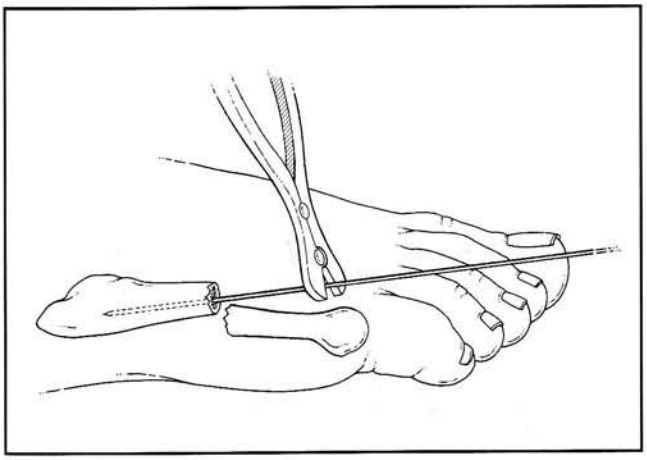

Figure 4A. The pin is driven into the proximal fragment and cut at an appropriate length.

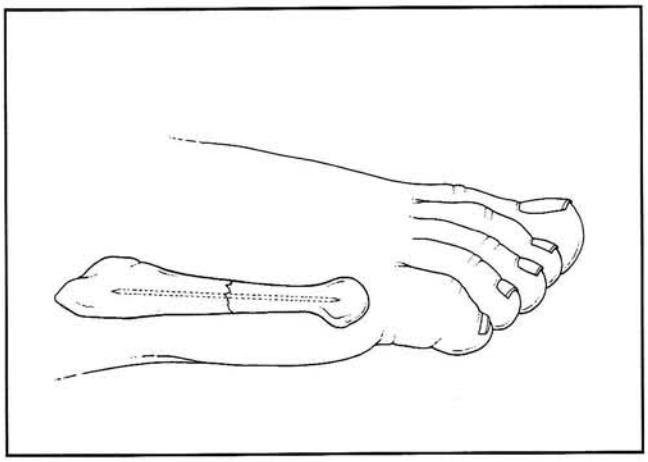

Figure 4B. This distal fragment is then anatomically reduced, keeping the pin internal.

FRACTURES OF THE METATARSAL SHAFT

Diaphyseal fractures of the fifth metatarsal account for 24% of all fractures of this bone. The most common pattern is a distal, short oblique fracture, with a consistent radiographic appearance (Figs. 5A, 5B). This fracture is also referred to as a "dancer's fracture" because of its frequent occurrence in ballet dancers. A small butterfly fragment is a routine component of this injury. The fracture is most often oriented from proximal-dorsal to distal-plantar (Fig. 6).

Figure 5A. Dorso-plantar radiograph.

Figure 5B. Medial oblique radiograph.

Figure 6. Lateral radiograph.

Short oblique fractures of the distal fifth metatarsal usually have a moderate degree of displacement and shortening due to the obliquity of the fracture, which allows the fragments to telescope relative to one another. Short oblique fractures occurring in the distal portion of the fifth metatarsal shaft usually result from a fall on an inverted and plantarflexed forefoot. The fracture occurs as a result of ground reactive forces acting distally against a stable proximal base. An example is forceful inversion of the foot while stepping down from a curb. Torque is produced within the shaft of the metatarsal causing an oblique fracture pattern.

Treatment Recommendations

Closed reduction may be attempted if significant displacement is present. However, in contrast to a transverse neck fracture, this type of injury is inherently unstable. If the fracture is in acceptable alignment, or the patient is not a surgical candidate, conservative treatment may be instituted consisting of a non-weight-bearing cast for 6 weeks. Clapper showed that non-displaced shaft and neck fractures treated in a below-knee walking cast heal in an average of 5.8 weeks.

If significant displacement or shortening remains after closed reduction, surgical intervention is recommended in an attempt to maintain even distribution of weight-bearing forces across the metatarsal parabola. The long-term sequela of a malpositioned distal metatarsal fragment, such as adjacent metatarsalgia and painful callus formation should not be overlooked. Oblique fractures of the fifth metatarsal may be readily fixated with small cortical bone screws. Internal fixation may also be accomplished with the use of small ASIF plates and screws.

Illustrated Surgical Technique. Complete visualization of the fracture line is obtained through a dorso-lateral incision over the metatarsal shaft. Distal traction is applied for adequate reduction of the fracture, and to eliminate any residual shortening that has occurred. The fracture site is irrigated and curetted to remove any hematoma or interposed soft tissue at the fracture site. Fixation is achieved using 2 to 3 small cortical bone screws. In situations where the metatarsal shaft is significantly comminuted, stainless steel cerclage wire or external fixation may be used to provide additional stability.

Figure 7. Lateral view of the right foot following the surgical preparation. This is the same patient as seen in figures 5 and 6.

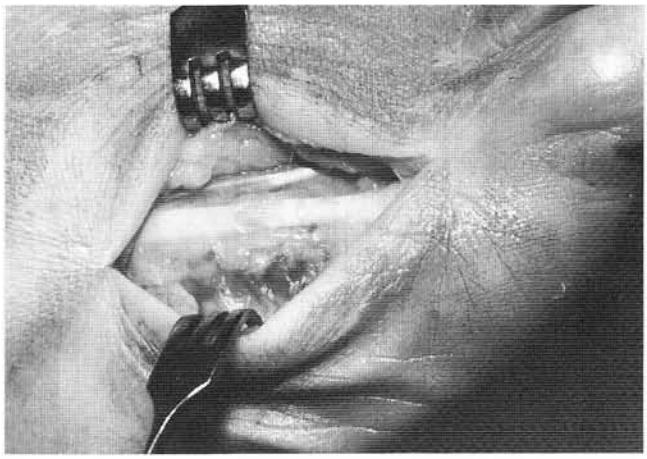

Figure 8. An incision has been made through the skin and subcutaneous tissue along the dorso-lateral aspect of the fifth metatarsal.

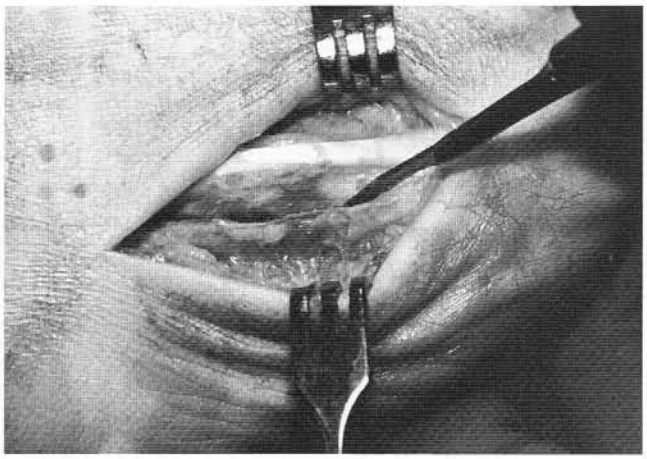

Figure 9. The periosteum is incised along the fifth metatarsal, lateral to the long extensor tendon to the fifth toe.

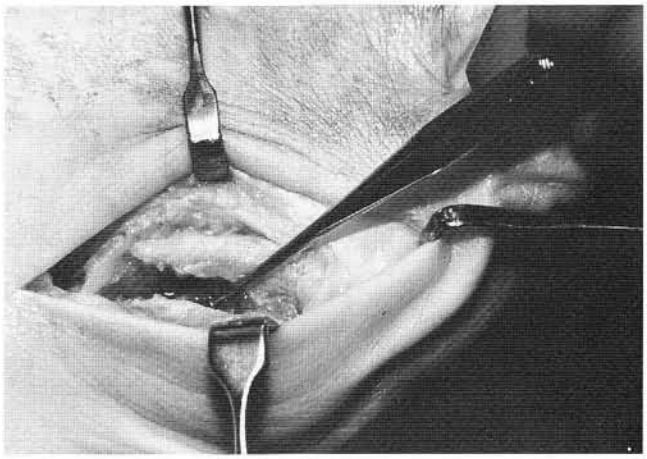

Figure 10. After reflection of the periosteum, the fracture is exposed, and the interposed hematoma and fibrous tissue is removed with a small curette.

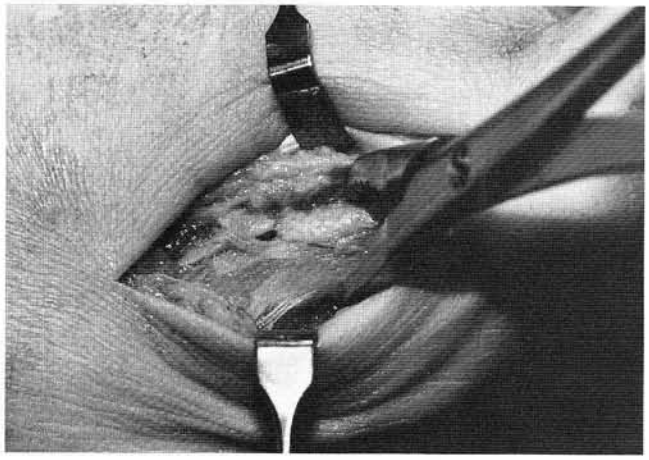

Figure 11. The distal fragment is anatomically reduced and held in place with a small alligator bone clamp.

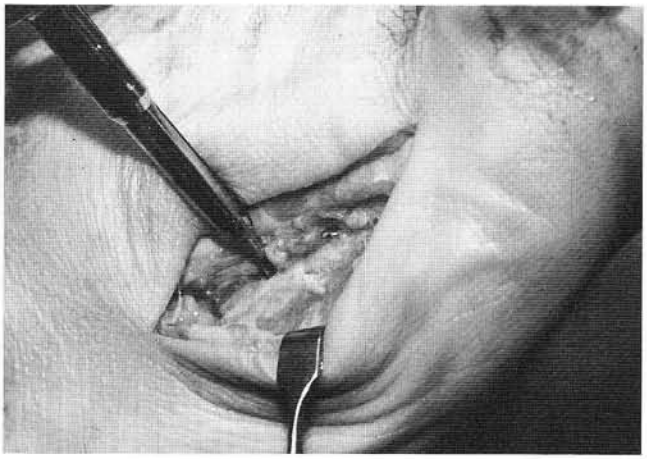

Figure 12. After the placement of two small cortical bone screws across the primary fracture, the dorsal butterfly fragment is reduced and fixated with a small compression screw.

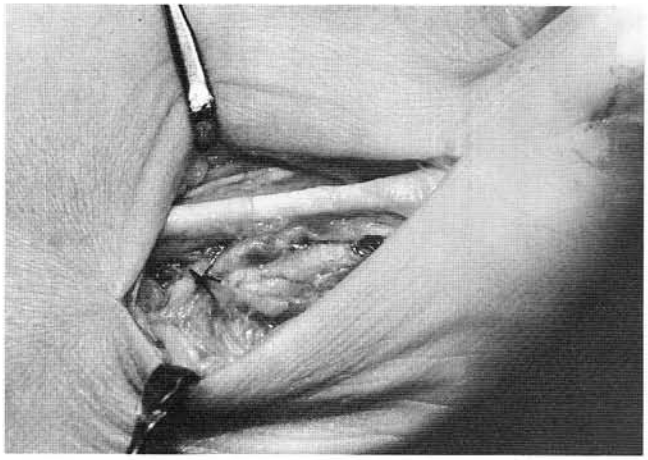

Figure 13. Initial closure of the proximal periosteum is performed.

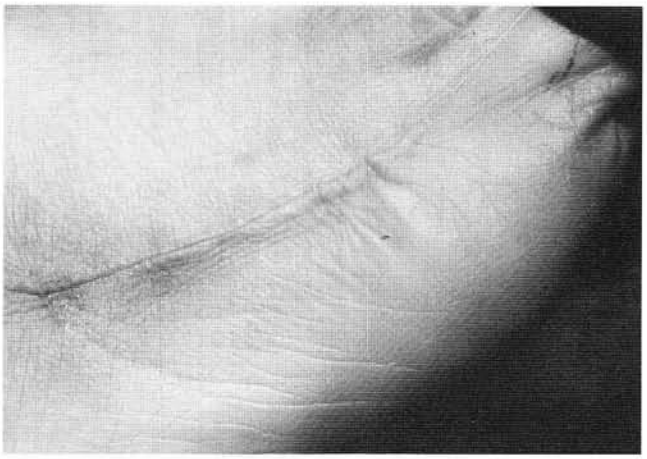

Figure 14. The incision is closed with 5-0 absorbable suture using a subcuticular technique.

Figure 15A. Postoperative dorso-plantar radiograph.

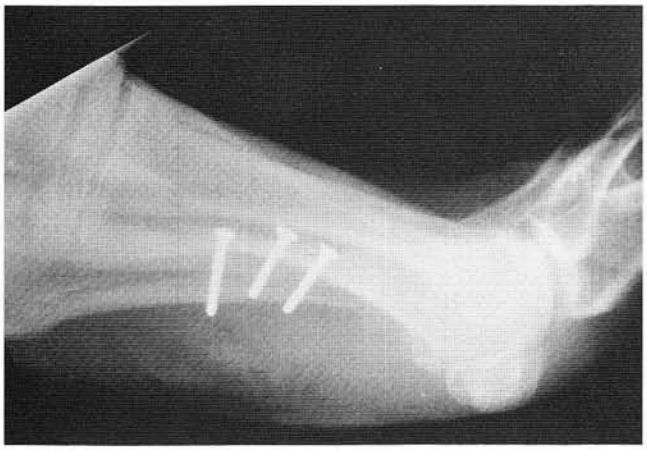

Figure 15B. Postoperative lateral radiograph. Note that good anatomic alignment of the fracture fragments and restoration of the metatarsal length has been achieved.

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