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FRACTURES OF THE PROXIMAL FIFTH METATARSAL

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Most of the controversy regarding fractures of the fifth metatarsal relates to injuries sustained in the proximal third of the bone. Controversies in diagnosis and classification of fractures of the proximal third of the fifth metatarsals are common and have been perpetuated by a rather lax usage of anatomic terms and applications of eponyms such as the Jones fracture.[1, 2, 6–8, 12, 17, 27] With regard to fractures of the proximal diaphysis of the fifth metatarsal, there are controversies about the importance of the acuity or chronicity of prodromal symptoms, the incidence and potential cause of delayed unions and nonunions of this portion of the bone, and the most optimal method of treatment[1–5, 8–10, 18, 19, 21] (Holmes GB Jr: The treatment of delayed unions and nonunions of the proximal fifth metatarsal with pulsed electromagnetic fields, unpublished data, 1994).

The orthopedic literature is replete with articles distinguishing among fractures of the tuberosity of the fifth metatarsal, those of the metaphysis, and those at the metaphyseal-diaphyseal junction.[1–10, 12–19, 21, 22] Controversy over treatment of fractures in this area centers around whether the treatment should be closed or open, primary or delayed; whether the fracture should be grafted with bone or fixed with an intramedullary screw or another internal fixation device; and whether the initial treatment of the athlete should be any different from that of the more sedentary person sustaining the same fracture. There also is debate about the rate of reinjury of the proximal third of the fifth metatarsal.

This article serves as an overview of proximal fifth metatarsal fractures, covering the cause, mechanisms of injury, and pertinent anatomy of this injury. I propose a classification scheme for fractures of the fifth metatarsal and give some historical and practical detail with regard to the treatment of each fracture type. A series of fifth metatarsal fractures and their treatment, with results and follow-up examination, is presented. A practical treatment algorithm for fractures of the fifth metatarsal is offered in the hope of minimizing future misunderstanding in patient treatment.

At least three, and probably six, fracture types occur with any degree of frequency in the proximal fifth metatarsal.[8, 18] We consider herein the fifth metatarsal tuberosity avulsion fracture (Fig. 1*A*); the (acute) Jones fracture (Fig. 1*B*); and the proximal diaphyseal stress fracture (Fig. 1*C*), which has been described as having three subtypes (Table 1).[18, 19, 21] Also occurring in this area in the immature foot are apophyseal distraction types of fifth metatarsal fractures. These injuries must be distinguished from injury to the sesamoid (os peroneum, os vesalianum) and tarsometatarsal complex, which can also commonly cause pain in the dorsolateral, proximal forefoot.

As varied as these fractures are, most fifth metatarsal fractures heal with immobilization. Surgical treatment may be required for

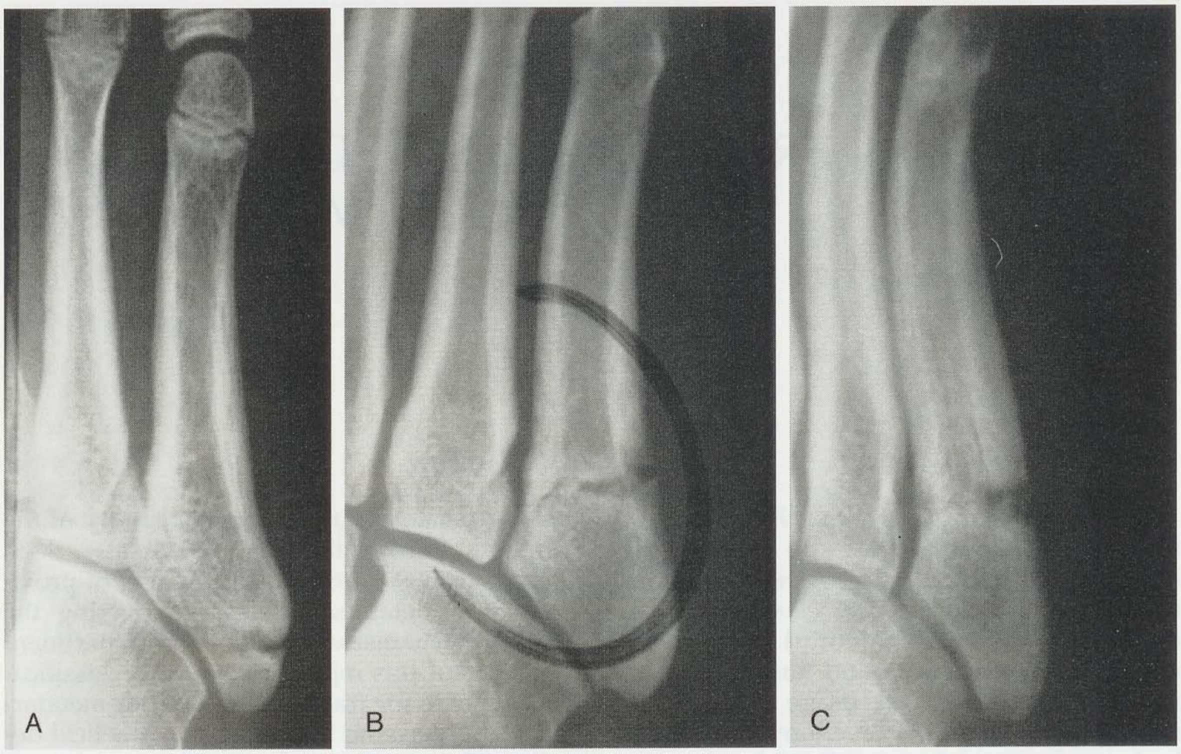

Figure 1. *A,* Oblique radiograph of fifth metatarsal tuberosity avulsion fracture. *B,* Oblique radiograph of a Jones fracture. *C,* Oblique radiograph of a fifth metatarsal proximal diaphyseal stress fracture.

certain proximal fifth metatarsal fractures to speed recovery time or to salvage delayed unions or nonunions. Surgery may also be indicated for displaced or intra-articular fractures.

ANATOMY OF THE FIFTH METATARSAL

The fifth metatarsal consists of a head, neck, shaft, tuberosity, and base (Fig. 2).[8] The tuberosity has also been referred to as the styloid process of the metatarsal. At its proximal end, the fifth metatarsal articulates at the cuboid–fourth metatarsal joint, the cuboid–fifth metatarsal joint, and the fourth and fifth intermetatarsal joint. Although there are individual anatomic variations, the tuberosity usually protrudes downward and laterally beyond the margin of the diaphysis and the adjacent cuboid. The peroneus brevis inserts over a relatively large area on the dorsolateral aspect of the tuberosity. The peroneus tertius tendon inserts more on the lateral surface of the metatarsal diaphysis distal to the tuberos-

Table 1. CLASSIFICATION OF PROXIMAL FIFTH METATARSAL FRACTURES

I. Tuberosity avulsion
II. Jones
III. Diaphyseal stress
A. Torg type 1: early
B. Torg type 2: delayed union
C. Torg type 3: nonunion

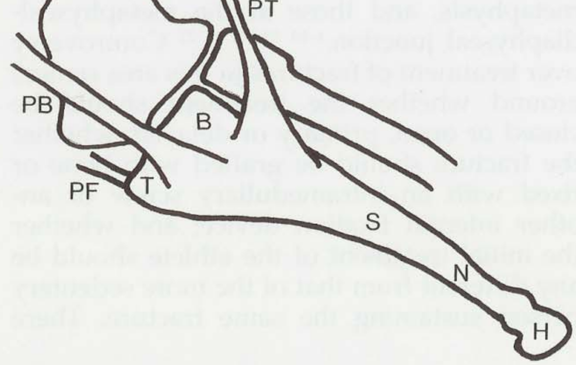

Figure 2. Schematic anatomy of the fifth metatarsal. H, head; N, neck; S, shaft; B, base; T, tuberosity; PT, peroneus tertius; PB, peroneus brevis; PF, lateral band of plantar aponeurosis/fascia (*modified from* Lawrence, Botte: Foot fellow's review: Jones' fracture and related fractures of the proximal fifth metatarsal. Foot and Ankle 14(6):1993; with permission).

ity. The origin of the abductor digiti minimi is on the lateral and medial processes of the os calcis, the calcaneal fascia, and the adjacent intermuscular septum. This muscle passes under and around the base of the fifth metatarsal, with a variable attachment to the bone. The muscle then continues distally to insert into the lateral side of the base of the proximal phalanx of the little toe.[20] Dameron[4] reports that this midportion attachment of the abductor digiti minimi was present in 18 of 20 feet that he dissected. In his anatomic series, only the peroneus brevis tendon appeared to be sufficiently strong in its attachment to the base of the fifth metatarsal in these 20 feet to cause avulsion of a bone fragment with inversion or adduction forefoot injury.

The origin of the flexor digiti minimi brevis is on the base of the fifth metatarsal, and the dorsal interossei and plantar interossei originate on the shaft of this bone.[4, 21]

In 1984, Richli and Rosenthal[15] attributed the commonly seen transverse fracture through the base of the fifth metatarsal to avulsion by the lateral cord of the plantar aponeurosis. Although these investigators could not produce a fracture by stressing the cadaver foot with the peroneus brevis intact, they thought that the tuberosity avulsion fracture caused by inversion and plantar flexion of the forefoot is due to traction on the lateral cord of the plantar fascia, not to avulsion at the peroneus brevis insertion in the in vitro setting. These authors, as well as others, are quick to differentiate this injury from the true Jones fracture or proximal diaphyseal stress fractures and concluded that the avulsion fracture is a relatively benign fracture that heals well with conservative treatment. Many authors do not agree that the cause of this injury is related to the plantar aponeurosis and recognize the importance of the attachment of the peroneus brevis.

Sir Robert Jones believed that the articulation of the cuboid and the fourth and fifth metatarsals was so secured by ligamentous attachments and joint capsule, as well as by the plantar fascia and broad insertion at the peroneus brevis, that injury here resulted in fracture of the fifth metatarsal rather than at the tarsometatarsal joint.[12] The true Jones fracture probably occurs with the ankle plantarflexed, when a significant adduction force is applied to the forefoot.

A secondary ossification center within the proximal end of the fifth metatarsal is not commonly present before the age of 8 years in either sex. This apophysis runs parallel to the shaft along the lateral inferior margin of the tubercle of the fifth metatarsal on radiographs. Fractures in this area are usually perpendicular to the long axis of the shaft. This apophyseal center does not extend proximal to the tarsometatarsal or fourth and fifth intermetatarsal joints as a fracture often does. This small area of mineralization is usually radiographically visible between the ages of 9 and 11 years in girls and between 11 and 14 years in boys.[4] The time between the appearance of this apophysis and its radiographic union to the shaft is usually less than 2 years.

With the foregoing age ranges in mind, Dameron[4] has noted that this apophysis may commonly be absent in children in this age group. This apophysis was not seen radiographically in as many as 50% of the children in this age range followed up chronologically by Dameron.

Dameron[4] has reported that the os peroneum is present within the peroneus longus tendon, near the proximal portion of the fifth metatarsal but adjacent to the cuboid in 15% of unselected foot radiographs (Fig. 3). In the same series, he identified an os vesalianum in 0.1% of these feet. When it was identified, the os vesalianum was more irregularly

Figure 3. The os peroneum lies within the peroneus longus tendon adjacent to the border of the cuboid.

shaped and longitudinally oriented and was found proximal to the insertion of the peroneus brevis on the proximal tip of the fifth metatarsal.

CLASSIFICATIONS OF PROXIMAL FIFTH METATARSAL FRACTURES

I propose the classification scheme outlined in Table 1 to aid in the management of proximal fifth metatarsal fractures. I have found this classification to be practical and to aid in the individualization of patient treatment. This fracture scheme should also provide better communication among treating surgeons and in published descriptions of this injury. Imprecise use of the term *Jones fracture* and failure to distinguish the true acute Jones fracture from stress fracture of the proximal diaphysis and from tuberosity avulsion fractures has created confusion in the orthopedic literature (Fig. 4).

Tuberosity Avulsion Fractures

The most common fracture of the proximal fifth metatarsal is the tuberosity avulsion fracture.[8] Past investigators have attributed this fracture to tuberosity avulsion by the contracting peroneus brevis muscle when the hindfoot is inverted. Cadaveric studies would lead us to believe that the firm attachment of the lateral band of the plantar aponeurosis is the structure more likely to cause tuberosity avulsion fractures than is the peroneus brevis. Most of these fractures occur at the tip of the tuberosity, where the plantar aponeurosis attaches, the peroneus brevis inserting more distal than this location.[13, 15] Only rarely is fracture displacement seen, even when the fracture is not immobilized (see Fig. 1*A*). Certainly, were the peroneus brevis the cause of the avulsion, muscular contraction and spasm would cause some displacement in the patient who was not immobilized.

This common tuberosity avulsion fracture is usually extra-articular, and it is occasionally associated with a concomitant lateral malleolus fracture that must not be overlooked by the treating physician.[11] When larger pieces of bone are avulsed, the fracture line may extend into the cuboid-metatarsal joint, and displacement of this intra-articular fracture may necessitate operative fixation. If operative treatment is selected, many options for fixation are available, but if the fracture is comminuted, it is often simpler to excise the fracture and reattach the insertion of the peroneus brevis to the metatarsal.

It is appropriate to mention again two types of injury commonly mistaken for tuberosity avulsion fractures.

Girls between the ages of 9 and 11 years and boys between 11 and 14 years old who commonly sustain inversion injuries of the foot and ankle may have a tuberosity apophysis present on radiographs without fracture and have a good prognosis with closed management. The nondisplaced tuberosity avulsion fracture does not have the smooth radiolocent line parallel to the metatarsal shaft that the apophysis has, and the fracture line is commonly perpendicular to the shaft of the bone. The tuberosity apophysis usually unites with the rest of the bone 2 to 3 years after its occurrence, and almost no adolescent of either sex older than 16 years still has an ununited apophysis.

The os peroneum is often seen adjacent to the lateral border of the cuboid within the peroneus longus tendon. The painful os vesalianum is found adjacent to the peroneus bre-

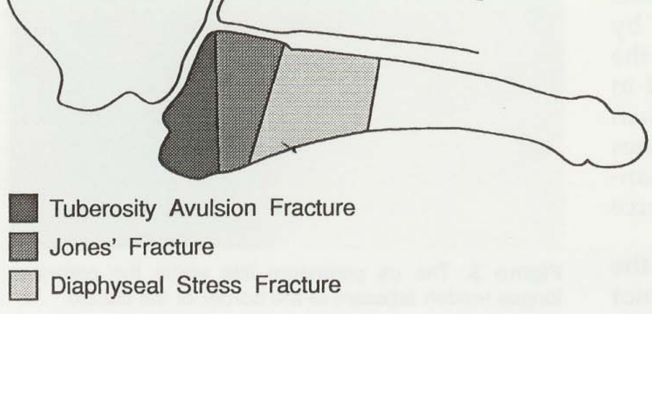

Figure 4. Schematic illustration of fracture zones for proximal fifth metatarsal fractures (*from* Lawrence, Botte: Foot Fellow's Review: Jones' Fracture and Related Fractures of the Proximal Fifth Metatarsal, Foot and Ankle, volume 14, no. 6. 1993; with permission).

vis insertion and has smooth edges unless the ossicle itself is fractured.

The recommended treatment of tuberosity avulsion fractures is generally symptomatic care.[7, 8, 11] A compressive wrap and ambulation to tolerance in a hard-soled shoe have been espoused as the treatments of choice. However, pain is a highly subjective complaint, and pain tolerance varies greatly from patient to patient. I have found that the patient with a nondisplaced, extra-articular tuberosity avulsion fracture is most comfortable when treated with protected weight bearing to tolerance in some type of fracture orthosis or cast that immobilizes both the foot and the ankle. This device may be discarded within 3 to 6 weeks as symptoms allow.

The displaced or intra-articular tuberosity avulsion fracture with excessive articular step-off is treated with open reduction, and internal fixation using mini–fragment plates and screws, closed reduction and pinning, or tension band wiring. A utilitarian approach to this and other fractures of the proximal fifth metatarsal is closed intramedullary cannulated-screw fixation. This technique is discussed later.

Jones Fracture of the Proximal Fifth Metatarsal

The true Jones fracture is an acute forefoot injury that occurs without a prodrome or a preponderance for age, sex, occupation, or sport (see Fig. 1*B*).[8] Stewart[17] defined the true Jones fracture as a transverse fracture at the junction of the diaphysis and metaphysis, without extension distal to the fourth and fifth intermetatarsal articulation. Medial comminution commonly is present. This fracture may be considered intra-articular and to involve the fourth and fifth intermetatarsal articular facet but should not be diagnosed if the main fracture line extends into the metatarsocuboid joint.

Unlike the proverbial lawyer who defends himself in court and has a fool for a client, Sir Robert Jones diagnosed his own injury and described the ultimate doctor-patient relationship as follows:

> Some months ago, whilst dancing, I trod on the outer side of my foot, my heel being off the ground. Something gave way midway down my foot, and I at once suspected a rupture of the peroneus longus tendon. By the help of a friend, I managed to walk to my cab, a distance of over 300 or 400 yards. The following morning I carefully examined my foot and discovered that my tendon was intact. There was a slight swelling over the base of the fifth metatarsal bone. I endeavored to obtain crepitus and failed. A finger on the spot gave exquisite pain. Body pressure on the toes, even the slightest, was painful; but when the pressure was deviated to the outer side, the pain was still greater. Extension of the ankle and flexion of the toes were immediately felt at the base of the fifth metatarsal.
>
> I hobbled down stairs to my colleague, Dr. David Morgan, and asked him to x-ray my foot. This was done, and the fifth metatarsal was found to be fractured about three-fourths of an inch from its base.[12]

In a 1902 edition of *Annals of Surgery*, Jones' report of six patients with fractures of the proximal portion of the fifth metatarsal was one of the first applications of diagnostic radiography published. The first patient in his series was himself. Perhaps some of the controversy over what constitutes a true Jones fracture stems from the fact that the reproduction of Jones' original foot radiograph is not readily interpreted. The films of other patients in his report, however, fit the description of the fracture described earlier by Stewart. It would seem that an adductor moment across the relatively fixed fourth and fifth metatarsal bases causes an acute fracture of the base of the fifth metatarsal at the area between the insertion of the peroneus brevis and tertius tendons. Even though the fourth and fifth metatarsals have good range of motion in the parasagittal plane, they are relatively immobile in the transverse plane, and this area of the foot serves as a fulcrum over which the fracture is sustained with adduction of the forefoot.

Many series, including Stewart's published in 1960, claim that the frequent occurrence of delayed union or nonunion is associated with nonoperative management of proximal fifth metatarsal fractures. It is quite likely that a good number of the fractures classified as Jones fractures in Stewart's and others' articles were actually diaphyseal stress fractures, which had a much poorer likelihood of healing with nonoperative management than did the acute, true Jones fracture. In 1972, Dameron[4] reported on 20 patients with fractures "within the proximal $1\frac{1}{2}$ centimeters" of the metatarsal shaft. Most were indeed diaphyseal stress fractures, but some were probably Jones fractures. Seventy percent of his patients were younger than 21 years. After 8 weeks of treatment, 5 of 5 of the fractures treated with bone graft healed, 12 of 15 healed with further immobilization (as long as 12 months), and 3 of 15 healed with nonoperative management but took up to 21 months to do so. Dameron[4] and Kavanaugh et al[7] reported a high refracture rate with nonoperative care for proximal fifth metatarsal fractures.

If these last several articles are interpreted at face value, it would appear that the vast majority of so-called Jones fractures, that is, about 75%, heal if placed in a cast for a long enough period; however, one third of these injuries managed closed refracture if followed up long enough. Twenty-five percent of all patients with proximal fifth metatarsal fractures that were not tuberosity avulsion fractures statistically do not heal with closed management, no matter how long they are followed up. Of the 75% that do heal, according to the current literature, one third experience refracture with nonoperative treatment. It follows that an argument for early operative management with either medullary screw fixation or bone grafting could be made, because 50% (one fourth plus one third of three fourths) of fractures treated closed either do not heal primarily or refracture once initial healing has been documented.

For the purposes of this article, and so that there will be less misunderstanding in future reports, I would like to adhere to the classification of these fractures given in Table 1. I therefore classify Jones fractures as an acute injury and recommend the following treatment.

The acute, nondisplaced Jones fracture should be treated with non–weight-bearing ambulation in a short leg cast for 6 to 8 weeks, except in the high-performance athlete or the informed patient who is not at all interested in conservative care. I personally prefer to operate on these patients early with medullary cannulated screw fixation. For the professional athlete, a decision between operative and nonoperative care may be influenced by the chronologic proximity to the playing season.

If the physician treating a patient with an acute, nondisplaced true Jones fracture elects for conservative care and sees no radiographic evidence of healing at 6 to 8 weeks, the treatment should be individualized by patient needs and expectations. Intramedullary sclerosis and a lucent fracture line are relative indications for surgery. Continued protection, maybe even in a removable fracture orthosis, may be considered prudent. An argument for medullary screw fixation or bone grafting in the patient with an acute nondisplaced proximal fifth metatarsal Jones fracture that does not demonstrate adequate healing at 6 to 8 weeks could also be made.

The patient with the acute Jones fracture that is displaced should undergo early operative fixation with either closed medullary cannulated-screw fixation or the surgeon's preference from the following: tension band wiring, mini–fragment screws and plates that are low profile, and cross-pinning with Kirschner wires with further immobilization. The advantages of closed medullary screw fixation with a cannulated-screw technique with intraoperative fluoroscopic guidance are that the technique is relatively technically uninvolved; the technique does not open the fracture site; and, if the screw is placed appropriately, there is no need for subsequent hardware removal (Fig. 5). There is some controversy regarding hardware removal in high-performance basketball players, particularly those with a cavus foot shape. Screw removal in these patients is associated with an increased incidence of refracture.

When using this technique, I position the patient in the semilateral decubitus position and use intraoperative C-arm fluoroscopy. A tourniquet may or may not be necessary. A 3-cm incision paralleling the plantar border of the foot without invading the plantar pad is made beginning at the level of the tuberosity, extending proximally. The wound needs to extend proximally far enough that the proximal end of the cannulated guide wire can be brought very close to the lateral border of the foot. With the patient in this position and the foot resting in the plane of a 30-deg internal oblique fluoroscopic beam, the guide wire may be inserted down the medullary shaft parallel to the plantar border of the foot. The guide wire should engage cortex near the neck of the fifth metatarsal distally but not violate that cortex. A direct measurement of the screw length, allowing for countersinking of the head, should be made. I use a 7-mm cannulated screw (Synthes, Paoli, Pennsylvania) and usually choose a screw between 40 and 55 mm long. The screw length depends on the length of the metatarsal and the diameter of the narrowed portion of the diaphysis (isthmus). If the isthmus is narrow, a 4.5-mm cannulated screw may be sufficient for fixation.

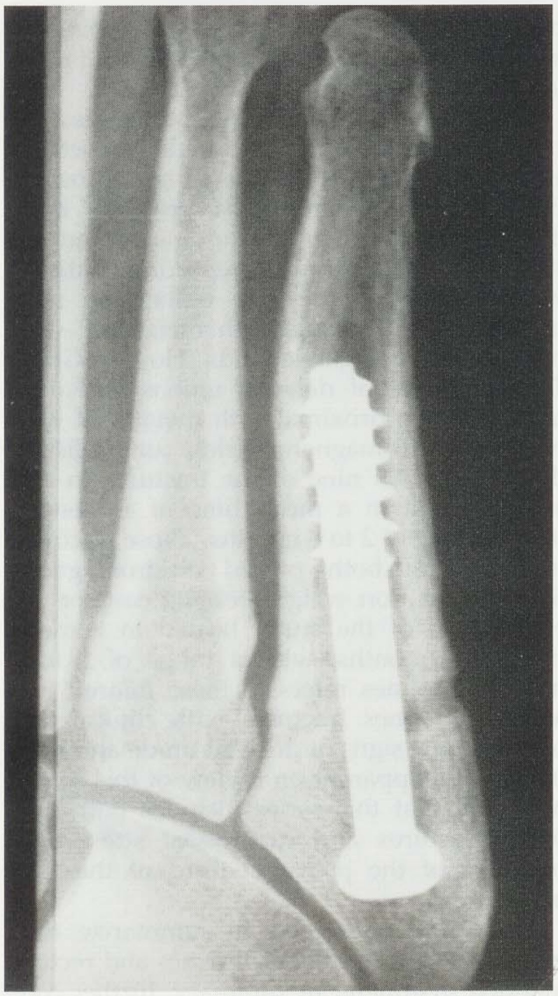

Figure 5. Oblique radiograph of a proximal fifth metatarsal fracture treated with medullary cannulated screw fixation.

I prefer a screw with a thread length of no more a 16 mm so that all the threads can gain purchase distal to the fracture site for compression. The cannulated screw is passed over the guide wire, radiographs are obtained, and the wire is removed. The patient is then immobilized in a plaster splint, which may be changed to a weight-bearing short-leg cast at 2 weeks' time when sutures are removed. In our series, one nonunion occurred with this technique in a patient who most likely had a pathologic fracture through dysplastic bone.

Proximal Fifth Metatarsal Diaphyseal Stress Fractures

Neither the history nor the biologic behavior of proximal fifth metatarsal diaphyseal stress fractures seems to parallel those of comparable fractures of other metatarsals. The treating physician needs to address the needs and expectations of the patient. This fracture behaves quite differently from the tuberosity avulsion fracture and the true, acute Jones fracture. It is a fracture resulting from repetitive cyclical forces applied to the foot (see Fig. 1C). DeLee et al[5] defined the stress fracture as a spontaneous fracture of normal bone which results from the summation of stresses, any of which by themselves would be harmless. Thus this type of diaphyseal stress fracture is associated with prodromal symptoms that may result in an acute-on-chronic episode before the patient presents. The surgeon looks for reparative responses in the bone, such as cortical stress hypertrophy and narrowing of the medullary canal and periosteal reaction. This type of fracture is definitely more rare than the other subtypes that are sustained acutely.

In 1978, Kavanaugh et al[7] reported that 41% of the patients in their series with fractures of the fifth metatarsal had prodromal symptoms. In 1979, Zelko et al[21] identified a lucent fracture line with periosteal reaction at initial presentation in 14 of their 21 patients (67%).

In 1983, DeLee et al[5] reported a series of athletes with a history of prodromal symptoms over the lateral aspect of the foot before the acute episode that precipitated presentation to the orthopedist, roentgenographic evidence of stress phenomenon in the fifth metatarsal, and no history of previous treatment for fifth metatarsal fractures.[5] Union was obtained in all 10 athletes who met these criteria for stress fracture at an average of 7.5 weeks after early axial intramedullary screw fixation. Seven of the 10 patients in that series, however, complained of local pain over the screw head. The reader is referred to the article by DeLee et al[5] for clarification of their technique for screw fixation.

In 1984, Torg et al[19] published an article that really helps distinguish the healing potential of fifth metatarsal diaphyseal fractures. In this report, they subclassified diaphyseal stress fractures of the fifth metatarsal into those that were acute (or early), delayed, or nonunions.

What they called an acute fracture was an early diaphyseal stress fracture with periosteal reaction, which represents an attempt of the bone to heal an incomplete fracture. The fracture type that they called delayed union had evidence of a lucent fracture line and medullary sclerosis. The obvious, established nonunions had complete medullary obliteration. These three subtypes of fifth metatarsal stress fracture are thought to represent a radiographic continuum of the typical stress fracture.

We have treated the Torg type I diaphyseal stress fractures in the same manner as acute, nondisplaced Jones fractures. Treatment may consist of prolonged avoidance of weight bearing and immobilization or, in the appropriately selected patient, early operative fixation. The type II diaphyseal stress fracture should be treated operatively with bone graft or medullary screw fixation, especially in the competitive, vigorous, or heavy-set patient. A much less vigorous patient could perhaps still be managed with prolonged immobilization without weight bearing.

The patient with a type III diaphyseal fifth metatarsal stress fracture has a symptomatic nonunion and requires surgical intervention. I prefer closed, cannulated medullary screw fixation to open methods, including tricortical inlay bone graft. Using this algorithmic approach to proximal fifth metatarsal fracture management, I have achieved a 100% union rate for tuberosity avulsion fractures of the fifth metatarsal, acute Jones fractures, and for Torg subtype I and II diaphyseal stress fractures of the fifth metatarsal. The only nonunion in a series of 35 consecutive proximal fifth metatarsal fractures treated over the past 4 years was encountered in a patient with a Torg subtype III established nonunion of a diaphyseal stress fracture. Even at cessation of treatment, this patient was asymptomatic. Her case is unusual in that she had dysplastic bone that most likely represented a case of osteogenesis imperfecta. At release from active orthopedic treatment, she had an asymptomatic fibrous type of union of her diaphyseal fifth metatarsal stress fracture.

The 35 fractures treated in this series were broken down as follows: The 14 tuberosity avulsion-type fractures were sustained in patients with an average age of 29.5 years and had an average time to union of 6.1 weeks. All of these fractures were treated closed. The 12 patients treated for Jones fractures had an average age of presentation of 41 years and healed with treatment dictated by this protocol at an average of 7.4 weeks. All but one of these patients was treated with an intramedullary large fragment screw. The 9 patients with a diaphyseal stress fracture healed at an average of 6.5 weeks and had a mean age of presentation of 37 years. All of these patients were treated operatively with the closed medullary screw fixation technique.

The current orthopedic literature does not contain a published report in which electrical stimulation has been evaluated by a prospective, randomized treatment protocol. Even though his study is not randomized and not prospective, Holmes is reporting data in which he treated delayed union and nonunion of the proximal fifth metatarsal with pulsed electromagnetic fields (Holmes GB Jr: The treatment of delayed unions and nonunions of the proximal fifth metatarsal with pulsed electromagnetic fields, unpublished data, 1994). All nine of the fractures in this series healed in a mean time of 4 months, with a range of 2 to 8 months. Those fractures treated with both pulsed electromagnetic fields and a non–weight-bearing cast for the entire time of the study healed in a mean time of 3 months, with a range of 2 to 4 months. Holmes refers to these injured feet as having Jones fractures with clinical and radiographic signs of delayed union and nonunion. It is apparent on review of this series, however, that this series includes both true Jones fractures and diaphyseal stress–type fractures of the proximal third of the fifth metatarsal.

Table 2 is presented to summarize fifth metatarsal fracture characteristics and recommended treatment. In summary, further controversy and misunderstanding regarding proximal fifth metatarsal fractures may be minimized if the classification scheme detailed in this article is considered. Tuberosity avulsion fractures are acute injuries, most of which can be treated closed. Operative intervention for these injuries is indicated if the fracture fragment is either very large and associated with a good deal of morbidity or intra-articular and significantly displaced.

The type II proximal fifth metatarsal fracture, otherwise known as the true acute Jones fracture, may be treated with non–weight-bearing short-leg cast immobilization, except in the vigorous or athletic patient, who should probably undergo early closed medullary screw fixation. The acute Jones fracture that is displaced on initial presentation should also undergo early operative intervention.

Treatment of the type I diaphyseal stress fracture parallels that for the acute nondisplaced Jones fracture. The type II diaphyseal stress fracture should be bone grafted or

Table 2. FRACTURES OF THE PROXIMAL FIFTH METATARSAL

Fracture Type	Mechanism of Injury	Location	Incidence	Synonym	Chronicity	Initial Treatment	Prognosis for Healing
Avulsion	Inversion of hindfoot	Tuberosity	Most common	Tennis fracture	Acute	Symptomatic	Excellent
True Jones	Adduction of forefoot	Junction of metaphysis and diaphysis	Uncommon	Jones or dancer's fracture	Acute	NWB/SLC or surgery	Good
Diaphyseal stress	Cyclical loading	Proximal diaphysis	Rare	Type of March fracture			
Torg type I		Narrow fracture line; no medial sclerosis			Acute-on-chronic	NWB/SLC or surgery	Fair to good
Torg type II		Wide fracture line; some medial sclerosis			Delayed union	Surgery	Variable
Torg type III		Complete medullary sclerosis			Nonunion	Surgery	Variable

NWB/SLC = no weight-bearing and short-leg cast.

should undergo medullary screw fixation, especially in the competitive athlete or vigorous patient. The type III diaphyseal stress fracture represents a symptomatic, established nonunion and requires surgical intervention in the form of bone grafting or screw fixation.

References

1. Acker JH, Drez D Jr: Nonoperative treatment of stress fractures of the proximal shaft of the fifth metatarsal (Jones fracture). Foot Ankle 7:152–155, 1986
2. Arangio GA: Proximal diaphyseal fractures of the fifth metatarsal (Jones fracture): Two cases treated by cross-pinning with review of 106 cases. Foot Ankle 3:293–296, 1983
3. Carp L: Fracture of the fifth metatarsal bone with special reference to delayed union. Presented to the Orthopaedic Section of the New York Academy of Medicine, April 15, 1927
4. Dameron TB: Fractures and anatomical variations of the proximal portion of the fifth metatarsal. J Bone Joint Surg Am 57:788–792, 1972
5. DeLee JC, Evans JP, Julian J: Stress fracture of the fifth metatarsal. Am J Sports Med 11:349–353, 1983
6. Hens J, Martens M: Surgical treatment of Jones fractures. Arch Orthop Trauma Surg 109:277–279, 1990
7. Kavanaugh JH, Brower TD, Mann RV: The Jones fracture revisited. J Bone Joint Surg Am 60:776–782, 1978
8. Lawrence SJ, Botte MJ: Jones fractures and related fractures of the proximal fifth metatarsal. Foot Ankle 14:358–365, 1993
9. Lehman RC, Torg JS, Pavlov H, et al: Fractures of the base of the fifth metatarsal distal to the tuberosity: A review. Foot Ankle 7:245–252, 1987
10. Lichtblau S: Painful nonunion of a fracture of the fifth metatarsal. Clin Orthop 59:171–175, 1968
11. Pearson JR: Combined fracture of the base of the fifth metatarsal and the lateral malleolus. J Bone Joint Surg Am 43:513–516, 1961
12. Peltier LF: Eponymic fractures: Robert Jones and Jones' fracture. Surgery 71:522–526, 1972
13. Pritsch M, Heim M, Tauber H, et al: An unusual fracture of the base of the fifth metatarsal bone. J Trauma 20:530–531, 1980
14. Rettig AC, Shelbourne KD, Wilckens J: The surgical treatment of symptomatic nonunions of the proximal (metaphyseal) fifth metatarsal in athletes. Am J Sports Med 20:50–54, 1992
15. Richli WR, Rosenthal DI: Avulsion fracture of the fifth metatarsal: Experimental study of pathomechanics. AJR Am J Roentgenol 145:889–891, 1984
16. Smith JW, Arnoczky SP, Hersh A: The intraosseous blood supply of the fifth metatarsal: Implications for proximal fracture healing. Foot Ankle 13:143–152, 1992
17. Stewart IM: Jones' fracture: Fracture of base of fifth metatarsal. Clin Orthop 16:190–198, 1960
18. Torg JS: Fractures of the base of the fifth metatarsal distal to the tuberosity: A review. Cont Orthop 19:497–505, 1989
19. Torg JS, Balduini FC, Zelko RR, et al: Fractures of the base of the fifth metatarsal distal to the tuberosity. J Bone Joint Surg Am 66:209–214, 1984
20. Warfel JH: The Extremities, ed 4. Philadelphia, Lea & Febiger, 1974
21. Zelko RR, Torg JS, Rachun A: Proximal diaphyseal fractures of the fifth metatarsal—treatment of the fractures and their complications in athletes. Am J Sports Med 7:95–101, 1979
22. Zogby RG, Baker BE: A review of nonoperative treatment of Jones fracture. Am J Sports Med 15:304–307, 1987

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