Bilateral Jones Fractures in a High School Football Player

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Objective: To present a case of a high school football player with bilateral Jones fractures who was treated both conservatively and with acute intramedullary compression screw fixation.

Background: Jones fractures tend to heal slowly, have a propensity for reinjury, and a significant number progress to delayed union or nonunion. Because of the time constraints imposed by athletic seasons, there is a need to avoid lengthy periods of immobilization.

Differential Diagnosis: Tuberosity fracture, metatarsal stress fracture.

Treatment: Treatment options include either conservative care or acute intramedullary compression screw fixation. Jones fractures are difficult to treat and can cause prolonged disability.

Uniqueness: The athlete was treated conservatively for a delayed union of an old stress fracture. X-rays revealed a sclerotic fracture line with partial union after 6 weeks. The athlete underwent open reduction and internal fixation using an intramedullary screw to obtain compression fixation and a graft to aid healing. Several months later, x-rays showed excellent resolution. One year later, he suffered a similar fracture of the other foot. Because of his history and his desire to return to play, he underwent open reduction and internal fixation using an intramedullary compression screw and was allowed to return to competition by the end of the sixth week postsurgery.

Conclusions: Treatment of Jones fracture should be individualized, based on the athlete's needs, the history and clinical presentation, and the initial radiographic appearance of the injury. The literature indicates that a rapid return to activity can be realized using rigid internal fixation and may be the treatment of choice in athletes.

Key Words: Jones fracture, rigid internal fixation, delayed union, nonunion

Fractures of the fifth metatarsal are a common injury in athletes[5] and are among the most common injuries seen by orthopedists.[2] Fractures of the proximal fifth metatarsal can be divided into two categories: those involving the tuberosity and those occurring distal to the tuberosity. Tuberosity fractures, often erroneously referred to as Jones fractures, usually occur with forced inversion. They are relatively easy to diagnose and normally heal with minimal treatment.[1,6] Fractures occurring in the proximal portion of the fifth metatarsal within 1.5 cm of the tuberosity are true Jones fractures, so named for the English physician who first described it in 1902.[3,8] This fracture tends to occur in young active individuals with 70% to 90% occurring between the ages of 15 and 22 years.[1,3,8,9] Kavanaugh et al[3] noted that the majority occur in football and basketball players.

While Jones fractures are not as common as tuberosity fractures, they are much more difficult to treat and can cause prolonged disability. They often require extended periods of immobilization for healing to occur, and a significant number of the fractures progress to delayed union or nonunion.[1,3,9]

CASE REPORT

A 15-year-old, 245-lb, 6 ft-2 inch, male football player sustained a Jones fracture of the left foot after landing from a jump while playing basketball during the spring of 1993. He was treated with cast immobilization and nonweight bearing for 1 week followed by 3 weeks of progressive weight bearing in a walking cast. The athlete was able to resume activities of daily living without problems during the remainder of the spring and summer. He began football practice 4 months postinjury and remained asymptomatic throughout the first 6 weeks of football before he complained of left lateral foot pain while playing offensive tackle during a junior varsity game. He indicated that his pain was over the proximal fifth metatarsal area and that it was "aching." He felt that he may have been stepped on during the game, but denied any pops or snaps in this area. He did admit to discomfort during practice 3 to 4 days before the game.

Physical examination revealed a bony prominence distal to the tuberosity that was consistent with old callus formation. He had tenderness with palpation of the callus area without crepitus. Ankle range of motion was full in all planes. Resisted eversion, inversion, plantar flexion, and dorsiflexion did not increase his symptoms. He was placed on crutches and toe-touch weight bearing until a follow-up exam by the team physician 4 days postinjury. A stress fracture was diagnosed with x-rays, which revealed a fracture of the proximal fifth metatarsal diaphysis with sclerosis and persistence of an old fracture line (Fig 1). We believed it to be a delayed union of the fracture incurred 6 months previously. The athlete was treated with rest, ice, cold whirlpool soaks, and partial weight bearing progressing to full weight bearing over the next 6 weeks. He improved symptomatically; however, repeat x-rays revealed a sclerotic fracture line with partial union.

Seven weeks postinjury, the athlete underwent open reduction and internal fixation using an intramedullary screw to obtain compression fixation and a graft placed to aid healing of the fracture (Fig 2). The athlete was kept nonweight bearing for the first 2 weeks and then progressed from partial to full weight bearing over the next 5 weeks. Two months postoperatively, he was asymptomatic with x-rays showing good alignment and a

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Fig 1. Oblique view of the left foot showing sclerosis and persistence of the fracture incurred 6 months previously.

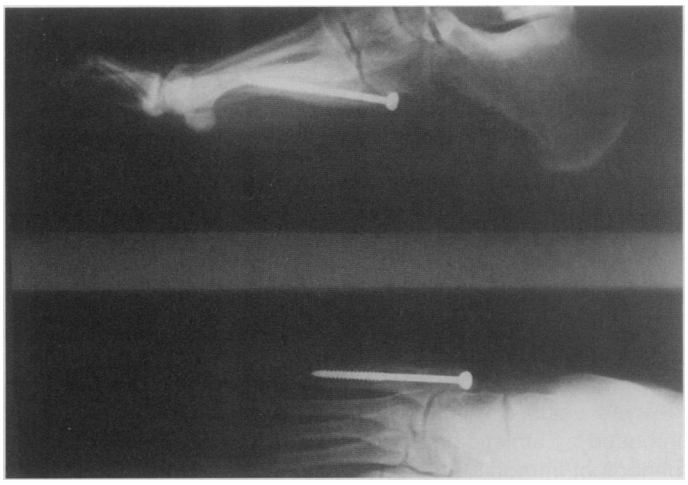

Fig 3. AP view of the left foot showing a healed fracture area with the screw in place.

Fig 2. Oblique view of the left foot taken 2 weeks postoperatively showing compression screw and graft in place.

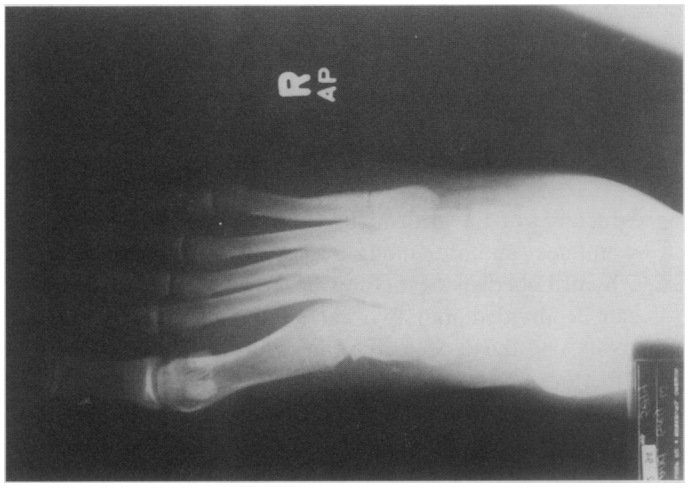

Fig 4. AP view of the right foot showing a nondisplaced transverse fracture.

healing fracture. Rehabilitation included ankle range-of-motion exercises, manual resistive exercise, proprioceptive activities, and cardiovascular workouts using a stationary bicycle and a stair climber. X-rays taken 7 months postoperatively showed excellent resolution of the fracture (Fig 3).

One year later, while at football practice, the athlete reported a pop in the lateral aspect of the right foot while running. He admitted to aching pain of 3 to 4 days duration before the acute episode. He also noted that the symptoms were very similar to those experienced in the left foot the previous year with aching and tenderness just distal to the tuberosity. A physical exam revealed a small localized area of swelling and tenderness coinciding with a transverse fracture of the proximal fifth metatarsal on x-ray (Fig 4).

With the history of delayed union and slow healing experienced with the opposite foot and the loss of the previous football season, this highly motivated athlete wished to return to activity as soon as possible. Five days postinjury, the athlete underwent open reduction and internal fixation using an intramedullary compression screw.

For the first week, the athlete was restricted to light partial weight bearing, used ice and electrical stimulation for edema reduction, and active ankle range of motion as tolerated. Following staple removal 10 days postoperatively, he was allowed to begin full weight bearing as tolerated, swimming, and stair climber workouts. At 17 days postsurgery, he was asymptomatic, full weight-bearing, and did not have any gait disturbance. X-rays showed good alignment of the fracture with significant callus formation (Fig 5). He was allowed to begin light football drills 21 days postsurgery and progressed without complaint to full practice at the start of the fifth week postsurgery and to competition by the end of the sixth week. To reduce the possibility of irritation of the healing fracture site, stationary cycling and stair climber workouts were used as alternatives to running for conditioning. The athlete was able to return to full participation without restriction for the last four games of the season. X-rays taken 10 months postoperatively showed a well-healed fracture (Fig 6). He is currently playing collegiate football without limitation.

DISCUSSION

Fractures of the proximal fifth metatarsal differ from other metatarsal fractures and the tuberosity fracture in particular, in

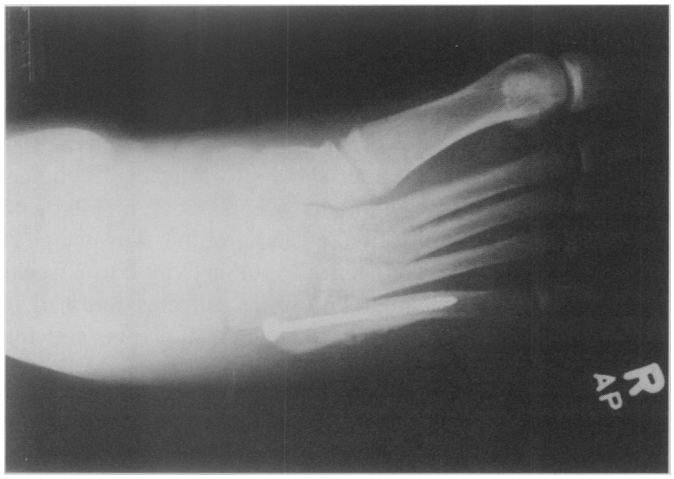

Fig 5. Oblique view of the right foot taken 17 days postoperatively showing significant callus formation and good alignment of the fracture.

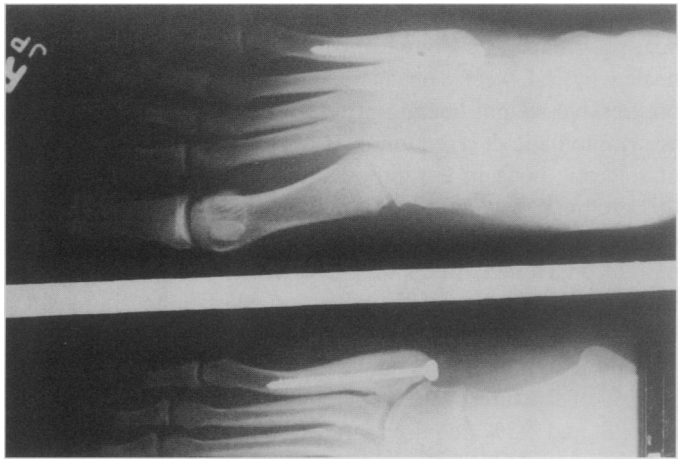

Fig 6. Oblique view of the right foot taken 10 months postoperatively showing a healed fracture with screw in place.

several important ways: inversion is not necessary to produce this injury,[3] it can be a source of prolonged disability, and it is considerably more difficult to treat.[1–3,5,9]

Inversion is commonly recognized as a mechanism for tuberosity fractures.[1] Kavanaugh et al[3] postulated through force-platform analysis that the inability or failure of the foot to invert is responsible for the forces that cause the Jones fracture. Elevation of the heel with extension at the metatarsophalangeal joints (as if landing from a jump with the heel off the ground) causes the lateral foot structures to be loaded and the forces concentrated on the diaphysis just distal to the tuberosity. Additionally, the base of the fifth metatarsal is stabilized by a multitude of strong ligamentous structures that firmly attach it to the cuboid and fourth metatarsal. Thus, it is easier to fracture distal to this area of strong stability than it is to dislocate.[3,4]

Fracture Types

The Jones fracture is often considered a stress fracture. Several investigators have noted that this injury is more commonly seen in the preseason or early-season athlete and that there is a high incidence of chronic stress reaction of the bone that predates the acute episode.[2,3,5,8–10] Kavanaugh et al[3] noted that it is similar to other stress fractures in its progression from an initial fracture of the lateral cortex, with widening of the fracture line, as it slowly traverses to engage the opposite cortex. This slow process leads to radiographic evidence of a long-standing stress reaction that includes periosteal reaction, sclerosis of the intramedullary canal, and callus formation.[3,8,9] Although this injury can present acutely without any prodromal symptoms, the etiology often is that of a stress injury that can be appreciated on radiographic examination.[3]

The Jones fracture can be categorized into several types based on the patient's history, clinical features, and initial radiographic findings.[3,8–10] Torg et al[8] categorizes these fractures by types. Type I, or acute fracture, is characterized by being clinically acute without previous fracture or injury, absent or mild prodromal symptoms, and a well-defined fracture radiographically without evidence of stress reaction of the bone. Type II, or subacute fracture, is also clinically acute with a history of prodromal symptoms of 1 to 2 weeks and possibly a previous injury. Radiographically, a lucent fracture line that involves both cortices with periosteal reaction and variable degrees of intramedullary sclerosis will be evident. This is referred to by Torg[8] as a delayed union type fracture. Type III, or chronic fractures, have a history of repetitive trauma, a widened fracture line, and obliteration of the intramedullary canal with sclerotic bone at the fracture site. These are often considered nonunions.[3,8–10]

The prognosis for Jones fractures, especially in athletes, is relatively poor. Kavanaugh et al[3] and Dameron[1] noted that delayed union of this fracture is not infrequent. Kavanaugh[3] noted a 66.7% incidence of symptomatic delayed union in their series. Laurich et al[4] suggests that ground forces are transferred proximally up the shaft during the gait cycle, causing disruption at the healing fracture site and may be responsible for delayed and nonunions. Blood supply has also been implicated as one of several possible causative factors in delayed unions and nonunions.[7] The arterial blood supply of the base of the fifth metatarsal and the proximal diaphysis merge in the area where Jones fractures occur. Fractures of the proximal diaphysis can disrupt the nutrient artery, resulting in an area of relative avascularity.[7]

Conservative Treatment

Considerable differences exist in the literature regarding acute treatment and its effectiveness in Jones fractures. Several authors advocate conservative treatment using cast immobilization, other forms of immobilization, or symptomatic treatment,[1,8–10] while others advocate a more aggressive approach such as acute intramedullary compression screw fixation.[2,3,5] Zogby[10] found subacute fractures (prodromal symptoms less than 2 weeks; signs of stress reaction without sclerosis) treated with nonweight-bearing cast immobilization for 9 weeks healed faster on average than acute fractures treated similarly. In this series of patients, 86% returned to their preinjury level of activity by 12 weeks. Torg et al[8] also noted, in their series of acute fractures, that those treated with immobilization and

progressive weight bearing healed slower than the nonweight-bearing group. The nonweight-bearing group were clinically healed by 7.4 weeks on average. The patients treated using progressive weight bearing progressed to either asymptomatic or symptomatic delayed union or nonunion requiring curettage of sclerotic bone in the intramedullary canal and grafting. In this progressive weight-bearing group of patients, clinical and radiographic healing of the delayed unions required 11.5 months on average. In contrast, Dameron's[1] series showed that healing can be quite slow using soft elastic dressings and a nonweight-bearing approach.

Radiographic union occurred between 2 months and 1 year in 60% of fractures. Fifteen percent required 15 to 21 months to heal and 25% required grafting. Zeldo et al[9] evaluated walking casts, strapping and orthoses, and rest as treatment. Only 2 of 15 patients treated with walking casts healed completely, the earliest being healed at 7 months and the other by 20 months. One of 2 treated with strapping and orthoses healed by 7 months, and the other required grafting for delayed union. Two patients treated with rest either reinjured and developed a symptomatic nonunion or were still not radiographically healed at 18 months postinjury. Kavanaugh et al[3] found that 40% of the patients in their series treated with cast immobilization for 5 to 10 weeks had refractures shortly after returning to activity, despite being clinically and radiographically healed. Overall, they found a 66.7% incidence of delayed union in those patients treated conservatively.

Surgical Treatment

A surgical approach to this problematic injury has been advocated because of the time constraints imposed by an athletic season, the lengthy period of time required for healing to occur with conservative care, and healing of this fracture in a significant number of patients is not obtained through conservative care.[1,3,8]

Grafting and intramedullary canal curettage is advocated for symptomatic delayed union and nonunion.[1,8,9] Curettage removes sclerotic bone that impedes healing and the placement of healthy bone in the form of a graft in the injury area, stimulating bony growth and recanalization, but it does not provide for rigid stabilization of the fracture site.[7] Clinical and radiographic healing postgrafting occurs in 3 to 4 months.[1,3,8,9] In the Torg et al[8] series, clinical healing was evident at 3 months postgrafting, but a return to full activity did not occur for 8 and 11.5 months in a delayed union and nonunion, respectively.

Several authorities[2,3,5] think the acute placement of an intramedullary compression screw for fixation is preferable in competitive athletes rather than a period of casting and nonweight bearing required with grafting and no rigid fixation. Compression screw fixation allows a more rapid return to activity and has low morbidity and a high success rate.[5] Smith et al[7] noted that the stability provided by compression screw fixation may be responsible for the rapid resolution of symptoms but that it could interfere with the body's attempt to re-establish the nutrient arterial supply. However, clinical union and absence of symptoms occurs more rapidly with screw fixation than with curettage and grafting. Kavanaugh et al[3] returned athletes in their series to full activity 6 to 8 weeks after fixation. In the Mindrebo[5] series, athletes returned to running by 5.5 weeks, full practice by 7.5 weeks, and full competition by 8.5 weeks, on average. Radiographic union was evident at 6 weeks postsurgically. Similarly, Delee et al[2] used compression screw fixation on subacute fractures. Clinical union (absence of tenderness and full weight bearing) occurred by 4.5 weeks and radiographic union by 7.5 weeks. All of the athletes in this series returned to full activity by 8.5 weeks on average. Treatment of the Jones fracture should be individualized, based on the patient's needs, the history and clinical presentation, and the initial radiographic appearance of the injury. The literature shows that a rapid return to activity can be realized using rigid internal fixation and may be the treatment of choice in athletes. This is true in the case of the athlete presented as he was able to return to full activity in less than 6 weeks.

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