Stress Fractures of the Lesser Metatarsals After a Wilson Osteotomy for Correction of Hallux Valgus Deformity

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This article describes a patient with lesser-metatarsal stress fractures resulting from an oblique Wilson displacement first metatarsal osteotomy. The shortening of the first metatarsal forces the lesser metatarsals to bear the weight previously borne by the first ray and increases the compression stress on the adjacent metatarsal heads. The proximal displacement of the osteotomy must be minimized in order to limit the risk of stress fracture of the lesser metatarsals. (J Am Podiatr Med Assoc 96(1): 63-66, 2006)

Hallux valgus deformity is the most common disorder of the first metatarsophalangeal joint, and several surgical procedures have been described for its correction depending not only on objective clinical and radiographic findings but also on subjective factors, such as the patient’s lifestyle and expectations. Complications that most commonly arise are those associated with lateral transfer of weight onto the lesser metatarsals that results in hypertrophy of the metatarsal shafts, metatarsalgia, or intractable plantar keratosis beneath the metatarsal heads. An uncommon complication is stress fractures of the lesser-metatarsal bones, which follow operations for surgical correction of hallux valgus deformity. This complication was first described in a ten-case series, and since then, several others have been reported. Lesser-metatarsal stress fractures have been reported after a Keller procedure more frequently than after a McBride bunionectomy. To our knowledge, ours is the first reported case of lesser-metatarsal stress fractures resulting from an oblique Wilson displacement first metatarsal osteotomy for the correction of hallux valgus deformity.

Case Report

A 60-year-old housewife presented to “Papageorgiou” General Hospital, Thessaloniki, Greece, with a painful bunion deformity of her left foot of more than 3 years’ duration. The pain was exacerbated by shoes and had increased in recent months. A slight degree of pronation of the great toe was noted, and during physical examination, a painful bursa over the first metatarsophalangeal joint and a hammer toe deformity of the second toe were observed. The dorsiflexion, plantarflexion, and digital palpation of the first metatarsophalangeal joint were painless.

Radiographically, a hallux valgus deformity of 22° without evidence of osteoarthritic changes at the first metatarsophalangeal joint was noted (Fig. 1). The patient, who had already been treated conservatively with padding and injection therapy that failed to reduce her pain, was scheduled for surgical treatment. She underwent a Wilson oblique displacement osteotomy of the first metatarsal, which was fixed with a screw, plus fusion of the distal phalangophalangeal joint of the second toe using a smooth Kirsch-
ner wire for correction of the hammer toe deformity (Fig. 2). The surgical technique that was used has been described by Wilson and consists of a dorsomedial curved incision over the bunion, reflection of the bursa as a distally based flap, removal of the exostosis in line with the shaft, and oblique (extending from medial to lateral and from distal to proximal, at an angle of \(45^\circ\)) osteotomy at the distal third of the first metatarsal. The distal fragment is displaced laterally, and the metatarsal is shortened and the position stabilized by positioning the big toe in slight overcorrection.

Fixation of the osteotomy was stable, and because the patient had intense family obligations, she began walking the day after surgery. Healing was uneventful for 3 months, but when she returned for follow-up she had pain and swelling of the foot that had gradually increased in the preceding 3 weeks. There was also localized tenderness over the second metatarsal. A radiograph showed the result of the fixed oblique displacement osteotomy of the first metatarsal in the healing process and a true second-metatarsal fracture, as a result of a stress fracture with hypertrophic callus formation (Fig. 3). The oblique nonweightbearing radiograph showed \(25^\circ\) of plantar angulation at the fracture site. She was instructed to limit her ambulation for a month, after which the patient was asymptomatic.

The patient gradually returned to her daily activities, and after 2 months, she returned for follow-up, again with pain and swelling of the forefoot. The radiographs showed another fracture as a result of the

Figure 1. Anteroposterior radiograph of the left forefoot with a hallux valgus deformity of \(22^\circ\).

Figure 2. A Wilson oblique displacement osteotomy was performed on the left first metatarsal, which was fixed with a screw, plus hammer toe surgery on the second left toe using a smooth Kirschner wire.

Figure 3. Radiograph taken 3 months after surgery showing the osteotomy of the first metatarsal in the healing process and a hypertrophic callus formation of a stress fracture of the second metatarsal.
stress fracture of the third metatarsal bone in 20° of plantar angulation (Fig. 4). The same conservative treatment was rendered, and the patient has remained asymptomatic for the past 2 years (Fig. 5). The screw was removed, at her request, 1 year after surgery under local anesthesia.

Discussion

Metatarsal stress fracture is characterized clinically by a gradual onset of pain, with swelling over the affected bone (usually the second), resembling symptoms of inflammation without a history of injury. Findings from initial radiographs (within 1 week after the onset of the symptoms) may be negative, whereas a second x-ray control 2 to 3 weeks later may reveal the fracture line with periosteal new bone formation. Stress fractures of the lesser metatarsals have been described after Keller operations and McBride or Mayo bunionectomies, which allow the sesamoids to move more proximally. LaPorta et al stated that stress fracture as a complication of the Keller procedure is due to a lack of retrograde stability at the first metatarsophalangeal joint because of the removal of the base of the proximal phalanx and the disruption of the intrinsic musculature. Compensation occurs through increased middle-metatarsal weightbearing. Any condition that eliminates weight-bearing of the toe of a given ray will result in a substantially increased load to the corresponding metatarsal head. Regarding the first ray, a basic reason for the fracture is that the patient began walking with the foot in forced varus attitude to avoid pain. Another factor that may have contributed to the creation of the stress fracture of the second metatarsal in our patient was the fusion of the distal phalangophalangeal joint of the second toe, which also forced her to walk with the foot in a varus position, especially during the first 3 weeks, as the Kirschner wire had been placed.

A metatarsal that becomes functionally shortened transmits a significant increase in compression stress to the adjacent metatarsal heads, creating fractures that resemble a domino effect until the compression force is exhausted. In the patient described here, the shortening of the first metatarsal created a compression force that resulted in fractures initially in the second and later in the third metatarsals with angulations of 25° and 20°, respectively, leaving the forefoot with a relatively normal-shaped metatarsal parabola; in other words, Mother Nature completed and improved the correction we performed. Another probable cause is reported to be the resumption of walking after a period of disuse. In the described patient, this cause does not apply because she started walking on the first postoperative day.

In general, if metatarsal stress fractures are displaced in the sagittal plane, operative reduction and pin fixation are indicated to prevent abnormal transfer of weightbearing to the other metatarsals. In the

Figure 4. Radiographs taken 5 months after surgery showing stress fracture (A) with hypertrophic callus formation of the third metatarsal in 20° of plantar angulation (B).
reported case, this was not necessary because the stress fractures were the result of adjustment of the forefoot to the new conditions (shortening of the first metatarsal). Thus this case report supports the belief that shortening of the first metatarsal affects the function of the foot, causing increased compression stress to the adjacent metatarsal heads. This compression contributes to the creation of stress fractures to form a relatively normal-shaped metatarsal parabola. It seems that the more shortening at the Wilson osteotomy site, the greater the risk of stress fracture and then true fracture of the lesser metatarsals. Moreover, other surgical considerations are 1) the age of the patient, as it is less likely to occur in children because they can compensate; 2) the sagittal plane position of the first metatarsal head after the osteotomy, which results in lateral transfer of the weight onto the lesser metatarsals; 3) the preopera-

tive metatarsal lengths, which affect the decision regarding the type of first metatarsal osteotomy to be performed to avoid shortening of the first ray; 4) the amount of motion and thus compensation in the midfoot and rearfoot; and 5) the first-ray hypermobility and the varus position of the midfoot and rearfoot during walking, which increase the risk of stress fracture and then true fracture of the lesser metatarsals.

References