# Surgery for symptomatic Freiberg's disease

## Extraarticular dorsal closing-wedge osteotomy in 13 patients followed for 2–4 years

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From 1992 through 1995, we have treated 13 patients (10 men) with Freiberg's disease by debridement and dorsal closing-wedge osteotomy of the metatarsal neck. The lesion was located in the second metatarsal head in 10 patients and in the third metatarsal head in 3. After osteotomy, the lesion was away from the joint, so that the smooth and healthy articular cartilage of the metatarsal head faced the phalangeal cartilage.

The average follow-up period was 40 (28–54) months. The subjective outcome was good or excellent in 11 patients, fair in 1, and poor in 1. We found MRI useful in determining the extent of the lesion when planning correction.

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Freiberg's disease is always situated at the front, dorsal part of the metatarsal head, and is considered to be a dorsal trabecular stress injury of the second or the third metatarsal head. Excessive pressure on the metatarsal head during weight bearing could cause repetitive microfracture, loss of blood supply to the subchondral bone, collapse of the cancellous bone, and cartilage deformation (Murphy and Richardson 1998).

The management of symptomatic Freiberg's infarction after failed closed treatment includes resection of the metatarsal head, elevation of depressed fragment and bone graft, joint debridement, excision of the proximal phalangeal base and metatarsal head replacement, but outcome is unpredictable. Gauthier and Elbaz (1979) described a technique of dorsiflexion osteotomy technique with good results. We have used debridement and dorsal closing-wedge osteotomy in 13 patients and describe our intermediate-term (28–54 month) outcomes.

## Patients and methods

From 1992 to 1995, 13 patients (10 men) underwent dorsal closing-wedge osteotomy for treatment of Freiberg's infarction, after closed treatment had failed. The mean age was 26 (19–58) years. The lesion was located in the second metatarsal in 10 cases and in the third metatarsal in 3. 7 patients were examined by MRI preoperatively and after removal of pins. 4 patients reported a trauma. 6 other patients had a history of chronic repetitive stress, including 1 basketball player, 1 paratrooper, 1 volleyball player, 2 recruits, and 1 patient had jumped rope regularly for 2 years.

Smillie (1957) described five stages of the disease from a fissure fracture (stage 1) to a final stage of deformity and flattening (stage 5) . According to this system, there were 7 cases of stage V, 5 of stage IV and 1 of stage III disease.

Surgery was performed under spinal anesthesia. A dorsal approach exposed the metatarsal head. The joint was debrided, loose fragments were removed, and a partial synovectomy was performed. Then a dorsal closing-wedge osteotomy was done over the distal normal metaphysis with sufficient bone removal to bring the healthy plantar part of the metatarsal head into articulation with the phalanx (Figure 1). The lesion was not removed, but only rotated proximally and dorsally. The angle of the closing-wedge depended on the area of avascular necrosis. We maintained the length of the in-

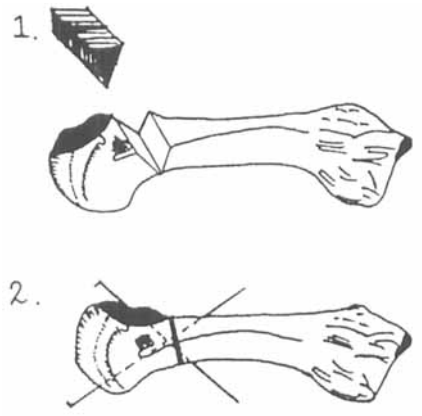



Figure 1. Dorsal closing-wedge osteotomy and cross-pinning.

volved metatarsal bone as much as possible. Temporary internal fixation with fine percutaneous Kirschner wire cross-pinning (Figure 2) was performed in all 13 patients. The foot was immobilized in a short-leg walking cast for 4 weeks, then the pins and cast were removed and weight bearing was allowed. All patients were advised not to run until 8 weeks after surgery.

The operative findings were similar in all 13 patients. The articular cartilage of the metatarsal head was softened and the joint was incongruent. Subchondral bone collapse was noted over 1/3 to 1/2 of the dorsal articular surface. The plantar surface of the involved metatarsal head was intact in all cases.

The mean follow-up was 40 (20–54) months. The clinical results were graded on a 100-point lesser toe metatarsophalangeal-interphalangeal scale (Kitaoka and Alexander 1994) modified from a forefoot score, based on the level of pain (40 points), function (45 points) and alignment (15 points). A score of 90 points or more was considered to be an excellent result; 80–89 points, a good result; 70–79 points, a fair result; and 69 points or less, a poor result.

## Results

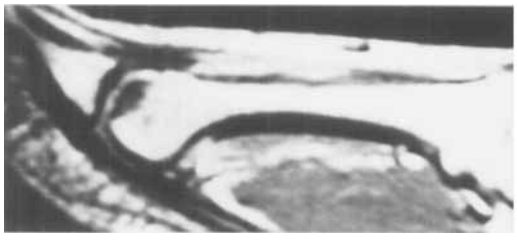
The patients were followed clinically and radiographically for a mean period of 40 (28–54) months. There were no cases of deep infection, non-union of the osteotomy site or further narrowing of the metatarsophalangeal joint. 4 patients had an excellent clinical result at the final follow-up examination and 7 had good results. 2 patients (1 fair, 1 poor) had pain, especially after prolonged standing or running.

The average metatarsal shortening was 2.1 (0–3) mm. 1 patient complained of transfer metatarsalgia. The metatarsal shortening in this patient was 3.0 mm. There was slight irregularity of the

Figure 2. A 21-year-old woman with Freiberg's disease.

Before operation. After operation. 3 years after osteotomy, showing good result.

Figure 3. A 19-year-old man.



MRI reveals the location and size of the lesion.

MRI after operation reveals that the lesion is away from the articulation.

metatarsal joint postoperatively, but there was no further narrowing of the joint space in any of the patients.

The passive range of motion of the metatarsophalangeal joint decreased by a mean loss of flexion of 15° (0–30°), and loss of extension of 8° (0–15°).

## Discussion

Freiberg's infarction is an uncommon disorder. Although Freiberg considered this disorder to be secondary to acute trauma, a review of the literature indicates that many patients have no history of trauma (Kinnard and Lirette 1989). Our finding that almost half of our patients engaged in activities or occupations that would place stress on the metatarsal head (jumping) suggests that repeated loading, with subsequent stress fracture of the metatarsal head, may play a key role in the etiology of Freiberg's infarction.

Non-operative treatment is thought to be effective in the early stages of the disease, including reduction in activity, casting or orthoses with metatarsal pads. Surgical intervention is considered only when closed treatment fails. Numerous procedures have been proposed for symptomatic Freiberg's disease, but most of them are salvage procedures (Katcherian 1994). Dorsal closing-wedge osteotomy was originally designed by Gauthier and Elbaz in 1979, who reported good outcome in 52/53 patients. This osteotomy moves the lesion away from the articulation and decompresses the necrotic lesion, thereby relieving symptoms (Young and Fornasier 1987). It is the least destructive surgical treatment and the only one which restores the congruity of the joint with a high proportion of good results, regardless of the stage of disease. Gauthier and Elbaz used wire for internal fixation of the osteotomy. We used temporary cross-pinning for 4 weeks. We found that pins were easier to apply than wiring and cross-pinning is more rigid. The only disadvantage of cross-pinning is that the pins should be removed before weight bearing. Gauthier and Elbaz removed unhealthy tissue during dorsal-wedge osteotomy, but we found that the remaining intact portion of the metatarsal head was too small for internal fixation to be performed. Thus we modified the procedure as also did Kinnard and Lirette (1989, 1991), by performing the closing-wedge osteotomy over the extraarticular normal metaphysis region at the margin of the joint. The lesion was not removed but merely rotated proximally, away from the articulation between the metatarsal head and the proximal phalangeal base.

Some authors advocate resection of the metatarsal head for late-stage disease. We also have some experience of this procedure, but found it led inevitably to transfer metatarsalgia with poor biomechanical and clinical results. The only patient in our series to suffer transfer metatarsalgia had metatarsal shortening of about 3 mm.

In our series, the postoperative loss of MTP joint flexion averaged 15° and most patients experienced no limitation in walking, jogging, and even jumping. We found MRI useful in determining the size and location of the lesions and in deciding the correction angle. MRI was also of value postoperatively for confirming that the lesion was away from the articulation of the proximal phalangeal base, and that decompression had occurred (Figure 3).

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