The distal metaphyseal chevron-type bunionectomy was first performed by Austin in 1962. In a follow-up study, Austin and Leventen\textsuperscript{1} state that a satisfactory bunion operation should redirect the first metatarsal head to create a uniform contact at the first metatarsophalangeal joint. The hallux valgus should be fully corrected. Most of the correction of the primus varus should be obtained. Rotation, or dorsiflexed attitude, of the first metatarsophalangeal joint, if present, should be corrected, and the first metatarsal should not be significantly shortened. . . . This ideal operation should have adequate stability to allow early ambulation without casts. We feel we have obtained essentially all of these features in the operation to be described.

The article then goes on to describe the horizontally directed V displacement osteotomy of the head of the first metatarsal, with the apex of the V pointing distally, combined with soft-tissue release and balancing on both sides of the joint. Impacting the capital fragment onto the metatarsal shaft allowed satisfactory stabilization, making fixation unnecessary.

Downey\textsuperscript{2} states that the disadvantages of this type of osteotomy include limited or only relative reduction of the intermetatarsal angle and the potential for osteotomy displacement and malunion if proper fixation is not achieved. Numerous studies\textsuperscript{3-10} have been performed since the addition of fixation to the original surgery.

Cain\textsuperscript{11} states that the complications of distal metaphyseal bunionectomy are minimal, for example, joint limitus, transient sesamoiditis, hallux varus, and recurrent hallux abducto valgus. It is stated that limitus and sesamoiditis may be minimized if the sesamoids are protected by performing a procedure such as the Austin-type chevron bunionectomy, in which the osteotomy intersects the plantar cortex proximal to the sesamoids. Also, hallux limitus is not common if early range of motion is instituted. Avascular necrosis, a potentially disastrous complication, is said to

Complications of Screw-Fixated Chevron Osteotomies for the Correction of Hallux Abducto Valgus

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The surgical records of three podiatric physicians were reviewed to identify all chevron-type osteotomies performed during 2000–2001 for the correction of bunion deformity, and complications were reviewed for each. In the 95 cases identified, 15 complications occurred in 12 patients. Of these 15 complications, 4 were soft-tissue infections (4 patients), 4 were cases of painful hardware (3 patients), 4 were cases of second metatarsal head pain (2 patients), 2 were cases of cystic changes initially interpreted as osteomyelitis but later determined to be degenerative changes (2 patients), and 1 was a case of stiff toe (1 patient). There were no cases of avascular necrosis, hallux varus, or recurrence. (J Am Podiatr Med Assoc 93(6): 499-502, 2003)

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have been observed only a few times in several thousand subcapital osteotomies performed by members of the Podiatry Institute. Several articles have been published on this complication. Gerbert describes the following as complications of the Austin-type chevron bunionectomy: 1) unstable osteotomy site, 2) intraoperative fracture of dorsal or plantar shelves of the capital fragment, 3) delayed union, 4) painful first metatarsophalangeal joint postoperatively, 5) postoperative hallux limitus, 6) postoperative hallux rigidus, 7) recurrent hallux abducto valgus deformity, 8) hallux adductus deformity, 9) excessive shortening of the first metatarsal, 10) lack of hallux toe purchase, and 11) avascular necrosis of the capital fragment.

Note that recurrence, although not really a "complication," is included in this list. Numerous studies have been performed on the complications of this type of procedure. The 1981 article by Austin and Leventen describes the 300 cases of complications (out of 1,200 patients) as 10% recurrence, and a few cases of hallux varus. Only 12 cases required re-operation and following realignment had no further problems; 5% of this group have had some discomfort with joint motion and/or slight limitation of joint motion. Less than half required arthroplasty revision. In this series, there was no significant shortening of the first metatarsal. . . no complications of thrombophlebitis, nonunion, or recognized avascular necrosis. No significant wound infections occurred, although 42 patients out of 1,200 had superficial and transient infections which cleared up promptly.

Rossi and Ferreira performed a retrospective study of 108 feet that had undergone distal metaphyseal chevron-type bunionectomy. Their complications consisted of three superficial wound infections, seven undercorrected bunions, one delayed union that eventually fused, and one medial marginal ossification that was asymptomatic.

Kalish and Spector performed a retrospective study of 265 feet in which a distal metaphyseal chevron osteotomy was performed using a long dorsal arm with screw fixation. Their complications consisted of 4 hallux varus overcorrections and 24 increased hallux abductus angles (undercorrections). They also followed up 53 feet for longer than 1 year. Complications in the long-term study included five cases of increased hallux abductus angles (undercorrections); there were no cases of hallux varus. Other potential complications cited included fracture of the dorsal arm, malunion, nonunion, hematoma, infection, nerve damage, and loss of fixation.

Selner et al performed a study of 121 feet in which a tricorrectional, chevron-type metaphyseal osteotomy was performed using screw fixation. Their patients did not experience any delayed unions or malunions, infections (bone or soft tissue), hematomas, or hallux varus. Two patients had wound dehiscence that resolved within 2 weeks. There was one case of transient fibroma related to absorbable sutures, one case of tibial sesamoiditis that resolved after 17 days, and one superficial skin reaction to a red-colored compressive dressing.

Donnelly et al performed a chevron osteotomy with a long plantar arm to accommodate screw fixation in 42 feet of 35 patients. No other procedures were performed on any of these patients. Outcomes were rated on subjective scales for pain, shoe fit, and cosmesis. Of 15 patients who returned for a follow-up appointment more than 1 year later, none experienced postoperative neuromas, paresthesia, or transfer metatarsalgia, and none had radiographic evidence of malunion, nonunion, avascular necrosis, metatarsophalangeal arthritis, hallux varus, or recurrence.

These studies describe a variety of surgeries performed over a certain period and then discuss the outcomes. Our study follows the same design by describing all distal first metatarsal chevron osteotomies fixated with screws performed during a 2-year period and then discussing the complications.

Procedure

The surgical records of three different surgeons were reviewed to identify all of the distal metaphyseal chevron-type bunionectomies with internal screw fixation performed in a 2-year period. These three physicians were chosen because they all used a similar technique for distal metatarsal osteotomy with a long plantar or dorsal arm to incorporate internal fixation with screws. The surgical record for each patient was reviewed to assess the complications, if any, and the final outcome.

Results

A total of 97 chevron-type bunionectomies were performed on 78 patients between January 1, 2000, and December 31, 2001. As two surgical records were unavailable, 95 records on 76 patients were reviewed. The average patient age was 48 years (range, 19 to 80 years). The average number of days between surgery and the final follow-up appointment was 157 (approximately 5 months; range, 7 to 655 days). Twelve patients experienced 15 complications from these 95 bunionectomies. Of these 15 complications, 4 were soft-tissue infections in 4 patients that occurred with-
in the first 2 months postoperatively, and all resolved with oral antibiotic therapy. Hardware removal surgeries were performed on four feet in three patients at 3, 3, 7, and 10 months postoperatively. Two patients (four cases) had pain associated with their second digits; one had bilateral second metatarsalphalangeal joint capsulitis that resolved with steroid injections within 14 months, and the other had pain under the second metatarsal head with contracture of the second digit bilaterally. This patient underwent bilateral second-digit hammer toe surgery 8 months later, which resolved the problem. There were two cases of cystic changes in two patients who were worked up and treated for osteomyelitis, but both cases were later determined to be degenerative changes. Of these two patients, one underwent a first metatarsalphalangeal joint arthroscopy 4 months postoperatively and was still having some pain at the last visit (7 months after the original surgery). The other patient was worked up and treated for osteomyelitis with antibiotics 4 months postoperatively. This patient had minimal symptoms and was later determined to have degenerative changes instead. One patient had a capsulotomy performed for a stiff toe 11 months postoperatively and had a good outcome. There were no cases of avascular necrosis, hallux varus, or recurrence.

Discussion

The total complication rate for the distal metaphyseal chevron-type bunionectomy performed on 95 feet (76 patients) during the 2-year study was 16% of cases in 16% of patients. Of the 15 complications noted, the two most common were soft-tissue infection (4.2% of cases) and painful hardware (4.2% of cases). Second metatarsal or second-digit pain followed, with 4.2% of cases but only 2.0% of patients. Only 2.1% of cases were worked up and treated for osteomyelitis, which was later determined to have degenerative changes. Hallux limitus occurred in 1.0% of cases. There were no cases of osteomyelitis or hallux varus.

These results show a higher percentage of complications than the results of three similar studies performed using screw fixation. Kalish and Spector,4 in their study of 265 feet, had a complication rate of 10.6%: 1.5% were hallux varus and 9.1% undercorrections. Scherer et al,5 in their study of 121 feet, had a complication rate of 4.1%: 1.7% were wound dehiscence, 0.8% were transient fibroma from deep sutures, 0.8% were tibial sesamoiditis that resolved, and 0.8% were superficial skin reactions to red dye. Donnelly et al,6 in their study of 42 feet (35 patients), did not list their complications but stated that all of the patients were satisfied. They examined 15 patients more than 1 year after surgery and stated that there were no cases of neuromas, paresthesia, transfer metatarsalgia, malunion, nonunion, avascular necrosis, metatarsalphalangeal arthritis, hallux varus, or recurrence. In all of the cases in this study, bunionectomy was the only procedure performed.

Two other studies of interest are those of Rossi and Ferreira3 and Austin and Leventen.1 In their study of 168 feet, Rossi and Ferreira3 had a complication rate of 7.1%: 1.8% were soft-tissue infections, 4.2% were undercorrected deformities, 0.6% were delayed unions, and 0.6% were medial marginal ossification. This study was included for comparison because its criteria for a complication were similar to those of the present study. Austin and Leventen1 did not provide an overall complication rate but stated that they had a 10% recurrence rate and a few cases of hallux varus in their study of 300 complications in 1,200 patients, of which 4.0% required another operation for realignment. Also, there was a soft-tissue infection rate of 3.5%.

Note that in all five of these studies,1–3,5,6 no cases of avascular necrosis or osteomyelitis were noted. Hallux varus was seen only in the studies by Austin and Leventen1 (approximately 1.0%) and Kalish and Spector4 (1.5%). Recurrence, although not really a complication but a remanifestation of symptoms, was seen in these same two studies in 10.0% and 9.1% of cases, respectively. Most of the complications noted in these five studies were mild and resolved. The two primary complications in the present study were soft-tissue infections and painful hardware, which were easily resolved by oral antibiotic therapy and hardware removal, respectively.

Soft-tissue infection is not an inherent complication of bunionectomy but a potential complication of any surgery. Of the previously mentioned studies, only those of Rossi and Ferreira3 and Austin and Leventen1 mention soft-tissue infections, at a rate of 1.8% and 3.5%, respectively. The rate in the present study was 4.2%.

Painful hardware, also a potential complication of any surgery in which hardware is used, was not mentioned in any of the three studies in which hardware was used. It is possible that the researchers did not include painful hardware as a complication. Eliminating painful hardware and soft-tissue infections from the complication rate in the present study produces a complication rate of 7.4% (7/95). It is difficult to compare various studies when the definitions of what constitutes a complication vary. In fact, neither Cain11 nor Gerbert15 mentions soft-tissue infection, painful hardware, or even osteomyelitis as a complication.
However, according to Mann\textsuperscript{14} in a letter to the editor, the literature regarding the Chevron osteotomy has, I believe, given many individuals a false sense of security in that so few, if any, complications have been reported. . . . As a result of this, complications are occurring in other people's hands which these authors may not be aware of. I personally have seen many of these complications associated with the Chevron osteotomy . . . .

He goes on to describe avascular necrosis, malalignment of the metatarsal head, excessive shortening, and hallux varus. None of these complications occurred in the present study. Only studies with a large number of cases (those of Kalish and Spector\textsuperscript{3} and Austin and Leventen\textsuperscript{1}) had hallux varus as a complication, and each of these studies involved more than 200 cases. It is possible that the rate for hallux varus, seen in these studies to be 1.0\% to 1.5\%, is so low that a study with a small number of cases will not show any. Avascular necrosis was not seen in any of the studies, and it has been argued that this is in fact a manifestation of other processes or etiologies.\textsuperscript{12}

Numerous factors can result in a complication. Downey\textsuperscript{2} and Hattrup and Johnson\textsuperscript{10} describe several of these, including physician technical errors and disregard of a procedure's indications. A review of the medical records of patients in the present study also revealed many patient profile factors involved. One patient had Parkinson's disease, one fell and sprained her ankle shortly after surgery, and many failed to comply with their range-of-motion exercise regimen. The type of activity each patient did may also have been a factor: a few of these patients were marathon runners, and some worked 12-hour shifts on their feet. How a patient perceives pain or a problem and subsequent anxiety over that pain or problem are also major factors, both before and after surgery.

Multiple other factors go into each patient profile as well. Some patients had mild hallux limitus along with the bunion deformity. Also, many of these surgeries were performed along with other procedures, such as Akin osteotomies, hammer toe procedures, neureoma excisions, and tailor's bunionectomies. The authors tried to include only complications that resulted from the bunionectomy, but there may have been some overlap. A study of patients who underwent only a bunionectomy would be difficult to perform and would have excluded almost three-quarters of the patients in this study. The severity of the hallux valgus deformity also contributes to the level of correction and the potential for failure. Other comorbidities that also contribute include obesity, old age, diabetes mellitus, rheumatoid arthritis, and Parkinson's disease. With each comorbidity, the potential for complications increases.

Conclusion

The results of this study show that the complications of distal metaphyseal chevron osteotomy for correction of hallux abducto valgus are infrequent and not very severe. Although this study showed a higher complication rate than some similar studies, the overall outcome was very good and consistent with the other studies. More severe complications such as osteomyelitis, avascular necrosis, and hallux varus can and do occur but in such small percentages as to be absent from this and many other studies.

References