Revision Lapidus Arthrodesis: Rate of Union in 17 Cases

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*This multicenter study retrospectively reviewed the medical records and radiographs of 15 consecutive patients (17 feet; mean patient age, 54.1 years), who underwent revision "bone-block" Lapidus arthrodesis for a symptomatic nonunion. In all cases but one, the procedure was performed with ipsilateral autogenous bone grafting. All cases used either screw fixation or a combination of screw and plate fixation. Patients were monitored for a minimum of 6 months postoperatively to assess clinical and radiographic union. Successful union was seen in 14 (82%) of the 17 feet that underwent revision. Nonunion was documented in 3 (18%) cases. These results support a favorable rate of union with the described surgical technique. Chi-square tests of association were used to determine whether gender, fixation, bone stimulation, and smoking were predictive of or associated with bone healing. Active smoking in the perioperative period was a predictor of nonunion (*P = .05*). Based on these findings, the authors recommend aggressive preoperative counseling, and smoking should be considered a relative contraindication to revision surgery.* (The Journal of Foot & Ankle Surgery 46(6):447–450, 2007)

Key words: revision arthrodesis, hallux valgus, metatarsocuneiform joint, Lapidus, nonunion

The modified Lapidus arthrodesis is a procedure commonly performed for the treatment of a hypermobile first ray resulting in symptomatic hallux valgus deformity, hallux limitus, lesser metatarsal overload, or first metatarsocuneiform arthrosis (1–5). Several publications evaluated functional outcomes of Lapidus arthrodesis and reported favorable results and patient satisfaction (6–10). This procedure however, is not without known complications, most notably nonunion. Several studies of the modified Lapidus arthrodesis for the treatment of hallux valgus deformity have commented on the rate of nonunion, ranging from 3.3% to 12% (6, 8, 10, 12–14). A recent, large multicenter study reported a nonunion rate of 5.3% with a curettage method (2). To date, there have been no studies on the rate of union after revision Lapidus arthrodesis. The purpose of this retrospective review is to determine the rate of union after revision arthrodesis in a limited number of cases with autogenous bone graft from the ipsilateral calcaneus or distal tibia. Potential predictors of nonunion in these cases were also analyzed.

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Materials and Methods

A multicenter retrospective review was performed. Medical charts, electronic databases, and radiographs were reviewed for 308 patients who underwent a modified Lapidus arthrodesis for a symptomatic hallux valgus deformity. All patients with a symptomatic nonunion after the primary operation were identified. Diagnosis of the index nonunion was confirmed by the treating surgeon and reviewed by the independent resident investigator (S. L. M.) at the time of data collection. This primary nonunion was defined both clinically and radiographically as failure of bone healing at the fusion site after 6 months, broken hardware, or both. Clinical nonunion was defined as a painful, swollen fusion site at the 6-month postoperative visit. Failure of osseous healing on radiographs was unequivocally defined as notable lucency or widening, sclerosis, broken hardware, or lack of bridging trabeculation at the fusion site. If broken hardware was not evident, but notable lucency was seen at the fusion site, the patient's condition was treated as a nonunion.

Fifteen consecutive patients (17 feet) were included in the study from December 2001 through January 2006. Patients who underwent a modified Lapidus arthrodesis and went on

TABLE 1 Type and outcome of treatment in 17 patients who had revision bone block arthrodesis

Pt	Age (y)	M/F	Days to fusion	Graft	Results	Fixation	Complication	Bone stimulator	Comments
1	49 CK	F	95	ICBG	Fused	Screws		External	Smoking/WB
2	44 RS	M	n/a	ICBG	Nonunion	Plate, screws	Hardware removal	External	Smoking/WB
3	44 RS	M	n/a	Autologous allograft	Nonunion	Screws		External	Smoking/WB
4	62 RT	F	74	ICBG	Fused	Screws		External	
5	60 JJ	M	80	ICBG	Fused	Plate, screws	Broken screw	External	WB
6	55 LC	F	n/a	ITBG	Nonunion	Plate, screws	Hardware removal	External	Smoking/WB
7	55 LC	F	42	ICBG	Fused	Plate, screws		Internal	
8	59 MG	F	59	ICBG	Fused	Screws		External	Smoking
9	44 JT	F	80	ICBG	Fused	Plate, screws		Internal	Prednisone
10	52 JZ	M	141	ITBG	Fused	Plate, screws		External	
11	51 RW	F	38	ICBG	Fused	Plate, screws	Hardware removal	External	
12	63 M	F	57	ICBG	Fused	Plate, screws		External	
13	64 JP	F	67	ITBG	Fused	Screws		External	
14	46 SP	F	73	ITBG	Fused	Plate, screws	Hardware removal	None	
15	55 CP	F	81	ITBG	Fused	Plate, screws	Hardware removal	None	Smoking
16	47 TB	F	65	ITBG	Fused	Plate, screws	Hardware removal	None	Smoking
17	71 PC	F	47	ITBG	Fused	Plate, screws		None	

Abbreviations: ICBG, ipsilateral calcaneal bone graft; ITBG, ipsilateral tibial bone graft; WB, weight bearing; F, female; M, male.

to solid fusion, as well as those who had an asymptomatic nonunion and did not desire surgical revision, were excluded from the cohort.

The same radiographic and clinical criteria were again used at 6 months to determine whether union had been achieved in the 15 patients (17 feet) who underwent revision "bone-block" arthrodesis. The only difference between the primary and revision "bone-block" radiographic criteria in determining successful fusion was consolidation of the arthrodesis site with obliteration of the joint space and incorporation of the autogenous bone graft. The surgeons performed radiographic and clinical assessments at 2 weeks, 6 weeks, 3 months, and 6 months postoperatively. All data were then reviewed by one of the investigators (S. L. M.).

The following data from the patients' medical records were recorded by the resident investigator (S. L. M.): age of patient, comorbidities, smoking status, compliance issues, index procedure technique and postoperative management, and revision procedure technique and postoperative management.

Data were compared by means of chi-square and Fisher exact tests.

Results

A total of 15 subjects, 17 feet (3 men: mean age, 50 years; range, 44–60 years; 12 women: mean age, 55.4 years; range, 44–71 years), were included in the study. The number of procedures contributed by the primary surgeons (G. H., S. M. R., L. A. F., J. M. S.) ranged from 1 to 4. Of the 17 revision procedures performed, 14 (82%) went on to complete union, whereas 3 (18%) failed to fuse.

In all cases, previous hardware was removed and the nonunion resected to healthy bleeding bone. The donor graft site involved harvest of a bicortical structural piece of bone from the ipsilateral distal tibia or the superior aspect of the ipsilateral calcaneus. In 8 cases, calcaneal graft was used; in 7 cases, distal tibial graft was used (Table 1). In 1 case, autologous cancellous bone chips and demineralized bone matrix were used. Internal fixation was achieved with long, solid screws or screws and a plate, depending on the surgeon. In 13 cases, 2 solid, crossed and stacked 3.5-mm cortex or 4.0-mm cancellous positional screws were used (Figure 1, *A* and *B*). In 4 cases, a single 3.5-mm or 4.0-mm positional screw was used along with a dorsal or dorsomedial 4- or 5-hole neutralization plate. Plate designs consisted of a standard 1/3 tubular compression plate or a reconstruction plate. Thirteen patients undergoing revision received bone stimulation immediately postoperatively. Twelve were external and 1 was internal. All bone stimulators were used throughout the entire postoperative course for an average time of 146 days. Four patients received no bone stimulation. Postoperatively, all patients were treated in a short-leg non-weight bearing cast for 6 weeks, with progression to a removable walking boot for 4 more weeks if radiographic consolidation was noted. Patients demonstrating incomplete radiographic consolidation at 6 weeks remained non-weight bearing in a short-leg cast for at least 4 more weeks. At an average of 10 weeks postoperatively, patients were advanced to regular supportive shoes with gradual return to regular activities as tolerated.

Two of the 3 cases that failed to unite were performed on the same foot by the same surgeon. Union was not achieved, and the patient remained symptomatic at the time of the review (Figure 2) The other case of nonunion underwent a second revision performed by a different surgeon and union