The Journal of Foot & Ankle Surgery 000 (2020) 1–3

Contents lists available at ScienceDirect

The Journal of Foot & Ankle Surgery

journal homepage: www.jfas.org

Original Research

Early Protected Weightbearing After Open Reduction Internal Fixation of Ankle Fractures With Trans-syndesmotic Screws

Christy M. King, DPM, FACFAS[1], Matthew D. Doyle, DPM, MS[2], Francesca M. Castellucci-Garza, DPM, MS[3], Annie Nguyentat, DPM, AACFAS[4], David R. Collman, DPM, FACFAS[5], John M. Schuberth, DPM[5]

[1] *Attending Staff and Residency Director, Kaiser San Francisco Bay Area Foot and Ankle Residency Program, Kaiser Foundation Hospital, Oakland, CA*
[2] *Fellow, Silicon Valley Reconstructive Foot and Ankle Fellowship, Mountain View, CA*
[3] *Attending Staff, Kaiser San Francisco Bay Area Foot and Ankle Residency Program, Kaiser Foundation Hospital, Antioch, CA*
[4] *Attending Staff, Foot and Ankle Surgery, Roseville Orthopedic Surgery & Sports Medicine, Roseville, CA*
[5] *Attending Staff, Kaiser San Francisco Bay Area Foot and Ankle Residency Program, Department of Orthopedics, Kaiser Foundation Hospital, San Francisco, CA*

ARTICLE INFO

Level of Clinical Evidence: 4

Keywords:
ankle instability
early mobilization
fracture disease
syndesmosis

ABSTRACT

Traditional postoperative care after open reduction internal fixation (ORIF) of unstable ankle fractures with syndesmotic instability includes non-weightbearing for 6 to 8 weeks. However, prolonged non-weightbearing may be detrimental. The goal of this case series was to assess the outcomes of early protected weightbearing after operative treatment of acute ankle fractures with syndesmotic instability requiring screw stabilization. Fifty-eight consecutive patients, treated from January 2006 to January 2013, met the inclusion criteria with a minimum follow up of 1 year. Electronic medical records and radiographs were reviewed for patient and surgical characteristics, postoperative complications, and maintenance of reduction. Patients initiated walking at an average of 10 days (range 1 to 15) postoperatively. Surgical treatment consisted of operative reduction with standard fixation devices and 1 or 2 trans-syndesmotic screws that purchased 4 cortices. All 58 patients maintained correction after surgery when allowed to weightbear early in the postoperative recovery. Five complications (8.6%) occurred in the 58 patients, which included 3 superficial infections (5.2%) and 2 cases (3.4%) of neuritis. The maintenance of reduction and low complication rate in this study support the option of early protected weightbearing after ankle fracture ORIF with trans-syndesmotic fixation.

Ankle fractures are a common injury, with >2 million new cases per year in North America (1). Trauma of the distal tibiofibular syndesmosis is present in ~23% of all ankle fractures (1,2). Indications for surgical intervention for unstable ankle fractures are well defined (2). Those fractures with syndesmotic disruption usually require trans-syndesmotic fixation. Historically, the postoperative protocol includes cast immobilization and non-weightbearing for ≥6 weeks. This postoperative protocol is intended to reduce the risk of fracture displacement, loss of syndesmotic reduction, hardware failure, and wound complications (3–6).

An increasing number of reports have heralded the benefits of early weightbearing and early range of motion after ORIF in acute rotational ankle fractures without syndesmotic fixation (3–12). The reported complications in these studies are similar to those in patients treated with immobilization and non-weightbearing. There is sparse literature examining early protected weightbearing after ORIF of acute ankle fractures requiring trans-syndesmotic stabilization. Recently, 2 papers concluded that early weightbearing in ankle fractures with syndesmotic fixation is not detrimental (13,14). The purpose of this study was to contribute to the body of literature and assess the maintenance of reduction and complication rates associated with early protected weightbearing in patients after ORIF of ankle fractures with trans-syndesmotic screw stabilization.

Methods

The institutional review board (Kaiser Permanente Northern California) approved this study. The medical charts of consecutive patients who sustained a closed ankle fracture requiring ORIF performed by 2 of the authors (D.R.C., J.M.S.) from January 2006 to January 2013 were reviewed. Inclusion criteria were the use of trans-syndesmotic fixation and weightbearing in a cast within 15 days after the operation. A

Financial Disclosure: None reported.
Conflict of Interest: None reported.
Address correspondence to: John M. Schuberth, DPM, Kaiser San Francisco Bay Area Foot and Ankle Residency Program, Department of Orthopedics, Kaiser Foundation Hospital, 450 6th Ave 5th Floor, San Francisco, CA 94118.
E-mail address: jmfoot@aol.com (J.M. Schuberth).

1067-2516/$ - see front matter © 2020 by the American College of Foot and Ankle Surgeons. All rights reserved.
https://doi.org/10.1053/j.jfas.2020.01.003

minimum of 12 months of postoperative follow-up was required for inclusion. The exclusion criteria were patients with peripheral neuropathy and those that had posterior malleolar fixation.

The surgical technique for internal fixation was dictated by the fracture pattern and typically consisted of a one-third semitubular plate with cortical and cancellous screws for the fibular fracture. Fully threaded cancellous screws or a tension band was used for the medial malleolus fixation. Syndesmotic stabilization consisted of one or two 4.0- or 4.5-mm screws that captured 4 cortices. The caliber and number of screws was at surgeon discretion. At the first postoperative visit, the patients were placed in a short leg walking cast in neutral position and instructed to bear weight as tolerated. None of the syndesmotic screws were removed, and none of the posterior malleolar fractures were fixated.

Medical charts, operative reports, and radiographs were reviewed by 2 authors (A.N., M.D.D.) not involved in direct patient care. Demographic characteristics of patient age, sex, body mass index, current tobacco use, and comorbidities were captured. Operative reports and the initial injury radiographs were evaluated to determine the operative side, fracture pattern, presence of dislocation at time of injury, and presence of a posterior malleolus fracture. The fracture pattern was classified based on initial injury films according to the Lauge-Hansen classification scheme (15).

Orthogonal non-weightbearing radiographs were taken immediately postoperatively and compared with the weightbearing radiographs taken at 6 weeks, 12 weeks, 6 months, and 12 months postoperatively. Maintenance of correction/loss of reduction was determined by evaluating tibiofibular overlap, ankle mortise alignment and congruence, and reduction of the medial clear space according to standard methods (16–19). The radiographic parameters were measured with digital calipers (Stentor Intelligent Informatics, I-site version 3.3.1, Phillips Electronics, Andover, MA). Failure of hardware was documented as loosening or breakage of the screws.

Medical charts were reviewed to capture the time to weightbearing in a short leg cast and the time that ambulation in regular shoes was allowed. Postoperative complications were recorded, including wound dehiscence, superficial or deep infection, and neuritis.

Results

Fifty-eight patients met inclusion criteria. Each surgeon performed 29 surgeries. Patient demographics are shown in Table 1. There were 30 male (51.7%) and 28 female (48.3%) patients. Thirty-one occurred on the left side (53.4%), and 27 on the right side (46.6%). The mean age was 46 years (range 15 to 85). Nineteen patients (32.8%) were age 60 and older. Mean BMI was 30.4 (range 17.6 to 45.2).

The injury characteristics are shown in Table 2. Ankle fracture patterns included supination external rotation and pronation external rotation. There were 8 (13.8%) ankle dislocations. The posterior malleolus was fractured in 30 (51.7%) of the cases.

Postoperative complications are depicted in Table 3. There were 5 total complications, which included 3 superficial infections (5.2%) and 2 reports of neuritis (3.4%). Four of the complications (80%) occurred in patients age ≥60 years. For the patients who experienced complications, the average time to weightbearing was 10 days. There were no deep vein thromboses or deep infections. There were no cases of medial clear space or syndesmotic widening. At 12 months postsurgery, all 58 patients had maintenance of reduction and returned to their preoperative level of walking.

Table 1
Patient demographics and comorbidities (N = 58 patients)

Demographic	Value
Body mass index (kg/m^2)	30.3 ± 6.7
Age (yr)	43.6 ± 20.0
Sex	
Male	30 (52)
Female	28 (48)
Comorbidities	
Diabetes	9 (16)
Peripheral neuropathy	5 (9)
Current smoker	7 (12)
Osteoporosis	4 (7)
Immunosuppression	2 (3)
Rheumatoid arthritis	1 (2)

Data are mean ± standard deviation or n (%).

Table 2
Characteristics of injury and fracture (N = 58 patients)

Characteristic	n	%
Dislocation	8	13.8
Posterior malleolus fracture	30	51.7
Lauge-Hansen Type		
Supine, external rotation 3	4	6.8
Pronation, external rotation 3	9	15.5
Pronation, external rotation 4	16	27.6

Table 3
Complications (n = 5)

Complication	n	%
Superficial infection	3	5.2
Deep infection	0	0
Deep venous thrombosis	0	0
Neuritis	2	3.4

Discussion

Traditionally, patients with these fracture patterns were not allowed to bear weight, primarily for fear of loss of reduction of the syndesmosis. The results of this study demonstrate that patients with unstable ankle fractures and syndesmotic disruption can be fully weightbearing within 15 days after ORIF without loss of reduction, hardware failure, or increase in complications. There was a low complication rate and no loss of reduction in our case series. These results are comparable to previous studies that involve early weightbearing in cases without syndesmotic involvement (5,6,10–13). They also reinforce the findings of the previously published works, demonstrating that loss of syndesmotic integrity is not potentiated by early weightbearing (13,14,20).

Prolonged non-weightbearing can be detrimental, particularly in the elderly and patients with comorbidities (4,20). In some cases, non-weightbearing is not realistic because of body habitus, frailty, and lack of coordination and upper extremity weakness. Moreover, early ambulation after ankle fracture surgery helps minimize deconditioning and is inherently appealing to patients.

Although we would not expect loss of reduction or hardware failure after 12 months of follow-up, we were not able to determine whether this protocol had any potentiation of the development of posttraumatic arthritis. Intuitively, patients with fractures requiring syndesmotic stabilization have more severe fractures that are more likely to culminate in posttraumatic arthritis (21). The damage to the tibial plafond at the time of injury often goes undetected, and the effect of early weightbearing may be detrimental in the early postoperative period. However, we believe that by eliminating motion and rotational forces at the ankle by virtue of the cast, all the load from weightbearing is transmitted to the central portion of the distal tibia, which is unlikely to be compromised.

We also did not analyze the fate of the syndesmotic fixation at 1 year, because we were primarily concerned with the integrity of the mortise. Had we observed cases of lost reduction, we would have analyzed whether the screws had broken or loosened to allow widening of the tibiofibular space.

Limitations of the study include that it was a retrospective analysis with a relatively small cohort that was not randomized. The medical comorbidities that were documented in this study were not evaluated independently as risk factors for complications. In addition, there was no functional outcome scoring system. We were not able to verify the extent of weightbearing activity after the walking cast was applied. It is possible that some patients did not assume weightbearing for an extended period of time after they were allowed. Lastly, we were not

able to determine if less robust methods of trans-syndesmotic fixation would withstand the weightbearing protocol. All of our cases had 4-cortex purchase, and in many instances, >1 screw was used.

In conclusion, the results of the present study support early protected weightbearing in patients undergoing ankle fracture ORIF with syndesmotic screw stabilization. However, further randomized controlled studies with extended follow-up and multivariate analysis are needed to determine whether there are any long-term negative consequences of this protocol.

References

1. *United States Bone and Joint Decade. The Burden of Musculoskeletal Diseases in the United States*. American Academy of Orthopaedic Surgeons, Rosemont, IL, 2008.
2. Purvis GD. Displaced, unstable ankle fractures; classification, incidence, and management of a consecutive series. Clin Orthop Relat Res 1982;165:91–98.
3. Gul A, Batra S, Mehmood S, Gillham N. Immediate unprotected weight-bearing of operatively treated ankle fractures. Acta Orthop Belg 2007;73:360–365.
4. Dehghan N, McKee MD, Jenkinson RJ, Schemitsch EH, Stas V, Nauth A, Hall JA, Stephen DJ, Kreder HJ. Early weight bearing and range of motion versus non-weight bearing and immobilization after open reduction and internal fixation of unstable ankle fractures: a randomized controlled trial. J Orthop Trauma 2016;30:345–352.
5. Starkweather MP, Collman DR, Schuberth JM. Early protected weight bearing after open reduction internal fixation of ankle fractures. J Foot Ankle Surg 2012;51:575–578.
6. Lynde M, Sautter S, Hamilton GA, Schuberth JM. Complications after open reduction and internal fixation of ankle fractures in the elderly. Foot Ankle Surg 2012;18:103–107.
7. Ahl T, Dalen N, Selvik G. Mobilization after operation of ankle fractures: good results of early motion and weight bearing. Acta Orthop Scand 1988;59:302–306.
8. Ahl T, Dalen N, Lundberg A, Bylund C. Early mobilization of operated on ankle fractures: prospective, controlled study of 40 bimalleolar cases. Acta Orthop Scand 1993;64:95–99.
9. Cimino W, Ichtertz D, Slabaugh P. Early mobilization of ankle fractures after open reduction and internal fixation. Clin Orthop Relat Res 1991;267:152–156.
10. Lehtonen H, Jarvinen TL, Honkonen S, Nyman M, Vihtonen K, Jarvinen M. Use of a cast compared with a functional ankle brace after operative treatment of an ankle fracture. A prospective, randomized study. J Bone Joint Surg Am 2003;85:205–211.
11. Egol KA, Dolan R, Koval KJ. Functional outcome of surgery for fractures of the ankle. A prospective, randomized comparison of management in a cast or a functional brace. J Bone Joint Surg Am 2000;82:246–249.
12. Bazarov I, Peace RA, Lagaay PI, Patel SB, Lyon L, Schuberth JM. Early protected weight bearing after ankle fractures in patients with diabetes mellitus. J Foot Ankle Surg 2016;56:30–33.
13. Pyle C, Kim-Orden M, Hughes T, Schneiderman B, Kay R, Harris T. Effect of early weight bearing following open reduction and internal fixation of unstable ankle fractures on wound complications or failures of fixation. Foot Ankle Int 2019;40:1397–1402.
14. Al-Hourani K, Stoddart M, Chesser TJS. Syndesmotic fixation in unstable ankle fractures: does early post-operative weight bearing affect radiographic outcome? Injury 2019;50:790–795.
15. Lauge-Hansen N. Fractures of the ankle: II. Combined experimental-surgical and experimental-roentgenologic investigations. Arch Surg 1950;60:957–985.
16. Pettrone FA, Gail M, Pee D, Fitzpatrick T, Van Herpe LB. Quantitative criteria for prediction of the results after displaced fracture of the ankle. J Bone Joint Surg Am 1982;65:667–677.
17. Pneumaticos SG, Noble PC, Chatziioannou SN, Trevino SG. The effects of rotation on radiographic evaluation of the tibiofibular syndesmosis. Foot Ankle Int 2002;23:107–111.
18. Joy G, Patzakis MJ, Harvey JP. Precise evaluation of the reduction of severe ankle fractures: technique and correlation with end results. J Bone Joint Surg Am 1974;56:979–993.
19. Schuberth JM, Jennings MM, Lau AC. Arthroscopy-assisted repair of latent syndesmotic instability of the ankle. Arthroscopy 2008;24:868–874.
20. Simanski CJ, Maegele MG, Lefering R, Lehnen DM, Kawel N, Riess P, Yücel N, Tiling T, Bouillon B. Functional treatment and early weight bearing after an ankle fracture: a prospective study. J Orthop Trauma 2006;20:108–114.
21. Horisberger M, Valderrabano V, Hintermann B. Posttraumatic ankle osteoarthritis after ankle-related fractures. J Orthop Trauma 2009;23:60–67.