Lagged Syndesmotic Fixation: Our Clinical Experience

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INTRODUCTION

Ankle fractures are common injuries with a reported incidence of 130 per 100,000 annually (1). The concurrent presence of injury to the deep deltoid and syndesmotic ligaments has been shown to further destabilize the ankle mortise, increasing the incidence and importance of operative reduction (2-4). The incidence of syndesmotic injuries in Weber B and C fractures has been reported as high as 66% and improved functional outcome of the ankle joint following anatomic restoration of the unstable mortise has been elucidated (5). The ankle joint functions in a well constrained system that tolerates malalignment and instability poorly, and the presence of which results in accelerated degeneration of the joint (6). Ligamentous instability of the ankle mortise is addressed with anatomic reduction and fixation with positional syndemsotic screw fixation. Biomechanic studies have noted the physiologic motion present within the syndesmosis and as a result, concern for restriction is pointed to as the prime reason for the utilization of non-lagged fixation across the syndesmosis (2, 7).

Despite evidence to the contrary that compression of the syndesmosis is not associated with restriction of ankle motion, the literature has continued to advocate against it (8). We found that in certain instances, the reduction achieved with the bone tenaculums could not be maintained with positional fixation intra-operatively and in cases of late syndesmotic widening during the postoperative course where the mortise appeared widened despite no obvious hardware failure. We thus began inserting all screws across the syndesmosis with lag technique. In vitro studies have demonstrated that the positional syndesmotic screw is associated with a loss of compression once the bone clamps are removed (1). We found our technique to be associated with maintained radiographic reduction through the postoperative course with no late widening. In addition we found no functional loss or subjective complaints with this technique and sought to present our outcomes with this technique. We specifically sought to demonstrate that based on our clinical experience with this technique, subjective ankle kinematics and clinical macroscopic evaluation revealed no restriction as has historically and theoretically been attributed to this technique. This is the largest in vivo study ever conducted evaluating this technique.

PATIENTS AND METHODS

Following institutional review board approval, we retrospectively evaluated functional outcomes, subjective complaints related to stiffness, and the American Orthopaedic Foot and Ankle Society (AOFAS) hindfoot questionnaire (9). We defined stiffness as motion not comparable to the uninjured contralateral limb. We were concerned about assigning specific numerical targets to the dorsiflexion and plantarflexion endpoints due to potential variables with individual flexibility and the presence or absence of preoperative gastrocnemius equinus in those patients in which this was their baseline.

All study investigators retrospectively analyzed radiographs. A thorough chart review of all consecutive ankle injuries requiring operative syndesmotic stabilization from January 2009 through December 2011 by the primary author (JJF) was performed by an author who was not blinded to the outcome of the results but took no part in patient care. These cases were identified by the Current Procedural Terminology code 27829 representing the open treatment of distal tibiofibular joint (syndesmosis). The study investigators were not blinded to the results. The AOFAS questionnaire was performed by an investigator who was not blinded to the results and participated in patient care.

A total of 275 operations in 273 patients were initially identified with this search criterion. Our inclusion criteria comprised patients who acutely sustained unstable syndesmotic injuries with or without operative fractures, patients who underwent syndesmotic stabilization with only screws that were placed with lag technique, patients who were ≥18 years of age, patients who were able to provide consent, closed injuries, and patients available for evaluation via AOFAS hindfoot questionnaire. Unstable syndesmotic injuries were defined by a tibiofibular clear space >6 mm and a medial clear space >5 mm (10-12).

Exclusion criteria included any other concurrent injuries beyond the identified ankle injury with the exception of osteochondral lesions identified intra-operatively, open fractures, syndesmotic screws placed under non-lagged technique, any stabilization performed without screws, patients <18 years of age, patients with documented neuropathy, nonambulatory patients, patients lost to follow-up, patients with previous operatively or nonoperatively treated ankle fractures unrelated to the acute or index injury in question, and patients with previous complaints of ankle pain or instability as reported by the history and physical.

Of our initial 275 operations, we excluded 12 (4.4%) cases in 12 patients who sustained severe crushing high-energy injuries, 16 (5.8%) pediatric fractures in 16 patients, 7 (2.5%) fractures with concomitant fractures to the ipsilateral limb in 7 patients, 5 (1.8%) patients with 5 previous ankle fractures to the ipsilateral limb, and 10 (3.6%) open fractures in 10 patients (13). Four (1.4%) patients requiring 4 operations on the ipsilateral limb for concurrent injuries not involving the ankle joint were also excluded. Two patients requiring reoperation on postoperative day 0 and day 19 postoperatively, respectively as a result of acute hardware failure, the first of which was due to a fall and the second of which was a result of gross ambulatory noncompliance were included. These 2 patients who underwent 2 operations on the same limb met our search criteria, resulting in 97 operations in 95 patients. Thus, the total number of evaluated ankles equated to the same number of patients.

An additional 124 (45%) patients were lost to follow-up as they no longer resided at the addresses they provided, the new current residents had no recollection of the individual nor a way to reach them, and finally the telephone numbers provided were either disconnected or assigned to another individual who had no knowledge of the patient. Ninety-seven operations (35.3%) in 95 patients of the initial 275 cases were available for chart review and included in this study (Figure 1). Complications were defined as unplanned surgical intervention following the definitive open reduction and internal fixation.

Surgical approaches involved a standard lateral incision directly over the distal fibular and the medial malleolus when indicated (Figure 2). In the presence of a concurrent operative posterior malleolar fracture, the aforementioned standard lateral incision was moved posteriorly and placed halfway between the posterior border of the fibular and the lateral border of the Achilles tendon to facilitate identification of the posterior malleolar fracture (Figure 3). A posterior plafond fracture that extended medially into a medial malleolar fracture was approached posteromedially with a curvilinear J-shaped incision just posterior to the medial malleolus. Syndesmotic stabilization was performed with fully-threaded cortical screws placed with lag technique to one full turn above two-finger tightness until the mortise was symmetric on fluoroscopy (Figure 4). All intraoperatively identified osteochondral lesions were microfractured with a microfracture awl. None were greater than 15 mm in diameter.

Following discharge, we additionally sought to evaluate patients from a long-term functional perspective to inquire of any impairment that could be attributed to this technique. Of these 95 patients, 31 (32.6%) were available for evaluation with the AOFAS hindfoot clinical rating system and questionnaire. The remaining 64 (67.4%) had relocated and could not logistically participate in this portion of the evaluation. We prioritized patient subjective reports, focused on the uninjured contralateral limb as our control, and previously described anatomic radiographic parameters (10-12).

We classified our fractures with the Orthopaedic Trauma Association classification of long bones (14). Of our 95 patients, there were 23 44-C (24.2%) fractures,

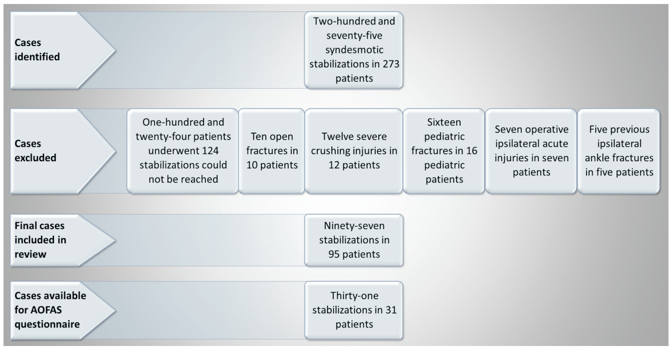

Figure 1. Patient population.

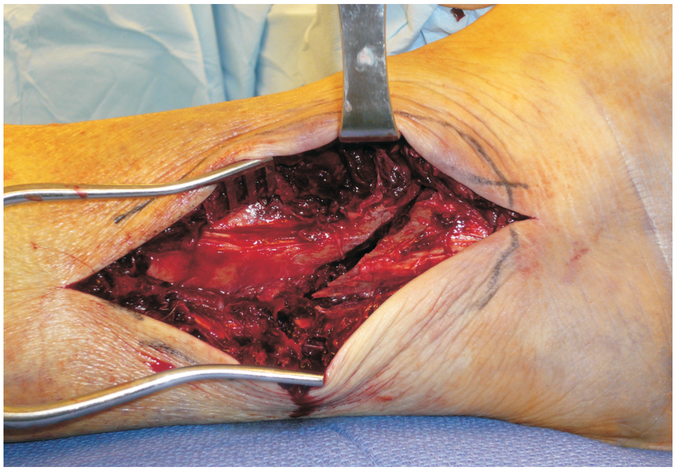

Figure 2. Standard lateral incisional approach for anatomic restoration of the fractured fibula.

Figure 3. Marked incision for the posterolateral approach in the presence of an operative posterior malleolar fracture.

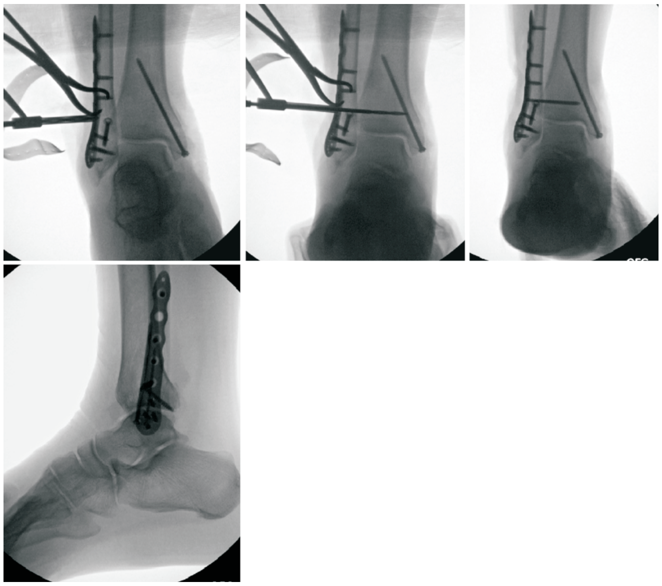

Figure 4. The sequential placement of a fully-threaded lagged syndesmotic screw demonstrated on the anteroposterior fluoroscopic projection where both cortices of the fibula are overdrilled. The lateral and medial tibial cortices are subsequently underdrilled. Only the lateral cortex in this instance was underdrilled because of the blocking effect of the medial malleolar screws. The syndesmotic screw is inserted to 2-finger tightness and up to a full turn beyond if the mortise is still asymmetric.

68 44-B (71.6%) fractures, 1 44-A (1%) fracture, and 3 isolated syndesmotic ruptures (3.2%) without fibular fracture.

Postoperative management consisted of immobilization in a well-padded posterior splint with the ankle in neutral alignment. Range of motion exercises were begun when the wounds were "sealed" and sutures/staples were removed. Serial radiographs were obtained at weeks 2, 6, 10, 16, and 20 postoperatively unless the patient was discharged before this time, then bimonthly until discharge if the patient required further follow-up. Progressive protected weightbearing was initiated when both radiographic and clinical union were present as demonstrated by the absence of pain, edema, or erythema at the fracture sites.

RESULTS

Mean follow-up for the 95 patients was 18 months (range 10-46 months). There were 55 males with a mean age of 49.58 years (range 19-84 years), and 40 females with a mean age of 46.1 years (range 19-81 years). Of the 31 patients available for AOFAS hindfoot questionnaire evaluation, there were 18 males (58.1%) and 13 females (41.9%). There were 16 right-sided (51.6%) and 15 left-sided injures (48.4%).

Of the 95 patients, there were 39 bimalleolar equivalent fractures (41%) defined by the presence of an isolated fibular fracture with a medial clear space >5 mm. There were 19 trimalleolar equivalent fractures (20%) defined by the presence of an isolated fibular and posterior malleolar fractures with a medial clear space >5 mm without fracture of the medial malleolus. There were 26 trimalleolar fractures (27.4%), 5 bimalleolar fractures (5.3%), and 3 Maisonnueve fractures (3.2%), one of which also presented with an operative posterior plafond fracture and a deltoid injury resembling trimalleolar equivalent. There were no bilateral injuries. There were 46 right-sided injuries (48.4%), and 49 on the left (51.6%).

Seven (7.4%) of the 95 patients underwent open reduction and internal fixation of their posterior malleolar fracture as it involved 25% of the plafond evaluated on the sagittal reconstruction computed tomography (CT). All fractures with posterior malleolar component underwent CT evaluation.

Among all the 5 bimalleolar fracture in the 95 patients, 2 (6.5%) were available for the AOFAS questionnaire and presented with scores of 90 and 100, respectively. The former complained of episodic weather-related uneasiness but functioned without restrictions. All 5 bimalleolar fractures in this AOFAS group were a result of low energy mechanical fall. On discharge for the 3 bimalleolar fractures not available for the AOFAS questionnaire, 2 reported no complaints whatsoever. The third however presented with subjective and objective stiffness, and presented for intraarticular cortisone ankle injections at months 8, 10, and 17 that resulted in symptomatic relief.

There were a total of 39 bimalleolar equivalent fractures (41%) among the 95, 11(35.5%) of which were available for the AOFAS questionnaire. Of this AOFAS subgroup, 1 was a result of an unknown mechanism. This same patient recorded an AOFAS score of 42 at a 43-month follow-up. She was subsequently diagnosed with multiple sclerosis that progressed during her postoperative course. Four (36.4%) in this AOFAS group were a result of high-energy injuries, and the remaining 6 (45.4%) were low energy rotational injuries. Only 1 (25%) of the high-energy injuries reported AOFAS scores ≥90, and conversely only 1 (16.7%) of the low energy rotational injuries reported a score of ≤90. Of the remaining 28 bimalleolar equivalent fracture patients not available for the AOFAS questionnaire (71.8%), 5 (17.8%) sustained high-energy injuries involving falls ≥6 feet. The remaining 23 sustained low energy rotational injuries (82.1%). The 5 patients who sustained these high-energy injuries yet not available for the AOFAS questionnaire were discharged at a mean of 6.4 months (range 2.5-8 months) with clinical motion comparable to the uninjured contralateral limb and no subjective complaints whatsoever. The remaining 23 patients who sustained low-energy injuries yet not available for the AOFAS questionnaire were discharged at a mean of 7.69 months (range 2-35 months). Among these same 23 patients, 1 required reoperation at week 3 week following the index procedure that involved reinsertion of the syndesmotic screw that was retrograding as a result of early weightbearing. This patient proceeded with an uneventful convalescence otherwise. Another required hardware removal at 19 months due to prominence and irritation of the lateral plate. A third patient received an intraarticular cortisone ankle injection that resulted in symptomatic relief. One patient however complained of stiffness upon discharged with clinically less motion than was available in the uninjured contralateral limb.

Among the initial 95 patients, 20 (21%) of which trimalleolar equivalent fractures (19 true trimalleolar equivalents by our definition and the third Maisonnueve with a mortise that presented as a trimalleolar equivalent), 8 (25.8%) were available for the AOFAS questionnaire. The mean follow-up on these 8 was 39 months (range 31-52 months). The mean AOFAS score for these 8 patients was 88.87 (range 64-100). There were 3 high-energy mechanisms among these 8, where the remaining 5 sustained low-energy rotational injuries. Despite their scores, subjective reports early in the postoperative course were less optimistic. Of the low energy group, 1 patient (20%) who underwent operative repair of a concurrent posterior malleolar fracture developed stiffness and pain 6 months postoperatively that was unresponsive to an intraarticular cortisone injection but developed some symptomatic relief following hardware removal at month 17. Another who concurrently sustained an operative posterior malleolar fracture complained of stiffness at 8 months but was resolved at their latest follow-up at 42 months. The remaining 3 patients (60%) who sustained low energy injuries and were available for the AOFAS questionnaire underwent benign and good outcomes defined by our criteria.

In the high-energy group, 2 (66%) of the 3 were available for our AOFAS questionnaire. One recorded a score of 85 and reported episodic weather related stiffness that resolved with increased activity. The other recorded a score of 89 at the latest follow-up of 32 months after undergoing removal of hardware and ankle arthroscopy at 7 months (Figure 5).

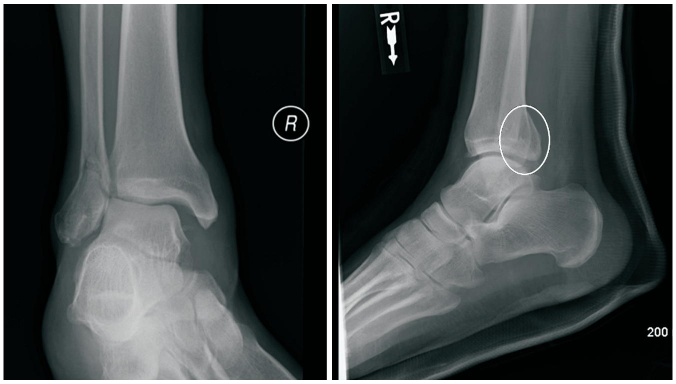

Figure 5A. Right bimalleolar equivalent ankle fracture following a motor vehicle accident.

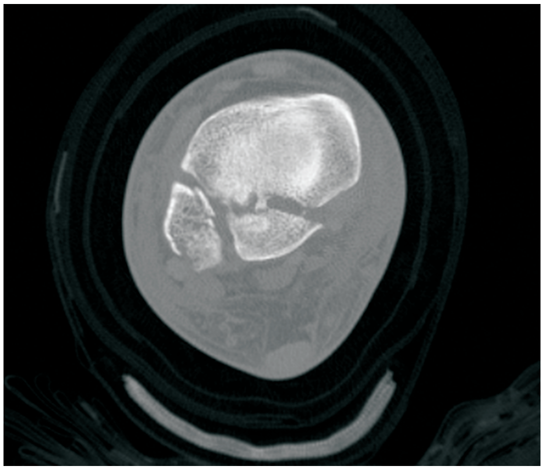

Figure 5B. Axial computed tomography image of a bimalleolar equivalent ankle fracture demonstrates a large posterior malleolar fracture with small intraarticular fracture fragments.

Figure 5C. Sagittal reconstruction of the posterior malleolar fracture with impaction slightly anterior to the concomittant posterior malleolar fracture.

Figure 5D. Sagittal reconstruction of a bimalleolar equivalent anke fracture with fibular comminution and impaction.

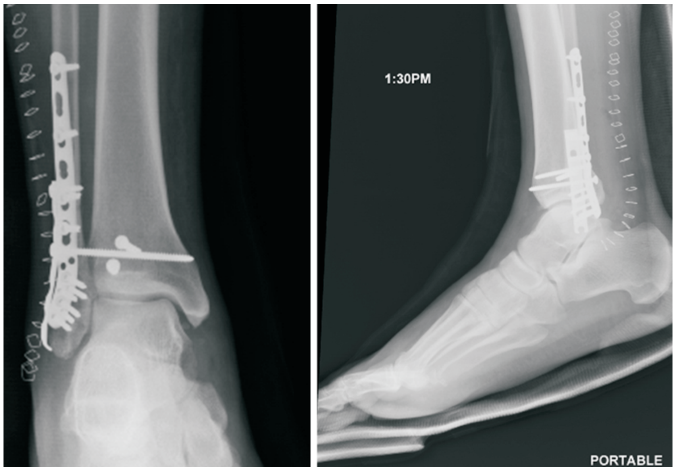

Figure 5E. Postoperative anterioposterior and lateral radiographs of a bimalleolar equivalent ankle fracture with double plating of the comminuted fibular fracture, open reduction with internal fixation of a posterior malleolar fracture, and lagged syndesmotic fixation.

Of the remaining 12 trimalleolar equivalent injuries not in the AOFAS group, 5 (41.7%) sustained high-energy injuries where the remaining 7 (58.3%) sustained low-energy rotational injuries. In this subgroup of non-AOFAS high-energy fractures, 2 patients (20%) presented with residual complaints at their latest follow-ups at 26 months and 32 months, respectively. The former sustained a concurrent operative posterior malleolar fracture after he was thrown off a motorcycle and was grossly noncompliant during the postoperative course, and presented at month 5 for the first postoperative follow-up. This patient went on to develop radiographic changes of post-traumatic arthritis 14 months postoperatively. The second patient continued to report residual stiffness at 10 months postoperatively.

In the non-AOFAS low-energy subgroup 1 patient (14.3%) with a concurrent operative posterior malleolar fracture presented with clinical stiffness at 18 months postoperatively. Another was diagnosed with ankle synovitis and received intraarticular cortisone injections that offered symptomatic relief at 8 and 30 months postoperatively. Two (28.6%) additional patients relayed weather-related changes that resolved with activity but on examination had hindfoot and ankle motion comparable to the uninjured contralateral limb.

Among the 31 patients in the entire AOFAS group, there were 2 operative posterior malleolar fractures (6.4%), both of which were associated with low-energy injury mechanisms. Of the 64 patients in the non-AOFAS group, there were 2 operative posterior malleolar fractures (3.1%) 1 of each in the high-energy and low-energy group.

Among the initial 95, there were 26 trimalleolar fractures, 8 (25.8%) of which were available for the AOFAS questionnaire. The mean score was 90.5 (range 60-100) within these 8, 6 (75%) of which were ≥90. These 8 all sustained low-energy rotational injuries, none of which sustained operative posterior malleolar fractures. One (12.5%) however sustained a concurrent osteochondral lesion that was visualized intra-operatively and complained of stiffness at 7 months postoperatively yet at the 38-month follow-up, reported mild and episodic pain with no restriction otherwise.

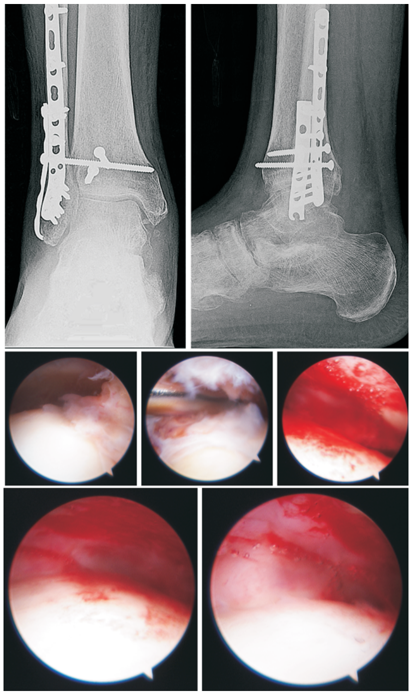

Figure 5F. Eight month postoperative anteroposterior and lateral radiographs with second look arthroscopy of a bimalleolar equivalent ankle fracture following a motor vehicle collision that underwent surgical repair with evidence of significant arthrofibrosis and residual chondral injury.

Fifteen (83.3%) of the remaining 18 patients in the non-AOFAS trimalleolar group all sustained low energy injuries and 1 (5.5%) sustained injury due to an unknown mechanism. This patient reported pain and stiffness on discharge at 6 months. The remaining 2 (11.1%) in the non-AOFAS trimalleolar fracture group sustained vehicular modulated injuries. There were 3 operative posterior malleolar fractures (16.6%) among these 18, none of which were among the high-energy injury group. Of the 3 who sustained operative posterior malleolar fractures, 1 presented with residual stiffness and restriction of motion on discharge. Another (6.7%) in this low-energy non-AOFAS trimalleolar fracture group sustained an osteochondral lesion. This patient continued to report pain 1 year postoperatively and clinically documented restriction. The third reported no symptoms whatsoever. The mean follow-up for the trimalleolar non-AOFAS group was 11.13 months (range 2.5-34 months). The only deep venous thrombus in the entire study occurred in this group.

Of the initial 95 patients, there were 3 Maisonnueve injuries (3.1%), 1 of which was already described in the trimalleolar equivalent group as the patient also presented with an operative posterior malleolar fracture. Of the remaining 2, 1 was available for evaluation with the AOFAS questionnaire. He recorded a score of 80 at 23 months and clinically demonstrated moderate restriction compared to the uninjured limb. At the latest follow-up of 20 months, the final of these 2 patients presented with no subjective complaints but documented restriction in range of motion.

Of the initial 95 patients, there were 3 isolated syndesmotic injuries (3.1%) of which only 1 (3.2%) was represented in the entire AOFAS questionnaire group. This patient sustained a rotational injury and at the latest follow-up, reported incisional pain. Another physician removed his hardware 13 months following the index procedure. Of the remaining 2, 1 presented with a completely normal examination at 11 months postoperatively, but sustained a fall and began reporting pain thereafter, underwent complete hardware removal at 22 months postoperatively, and at the latest follow-up at 24 months provided no complaints. The final patient underwent syndesmotic stabilization and at the last follow-up at 11 months, presented with no symptoms and a normal physical examination with clinical motion comparable to the uninjured contralateral limb.

Two (2.1%) patients of the 95 required acute reoperation and were included in the study. The first occurred on postoperative day 0 after sustaining a fall on ice and bending the syndesmotic screws. The second underwent reoperation of postoperative day 19 postoperatively as result of frank hardware failure due to gross ambulatory noncompliance.

There were a total of 7 cases (7.4%) of hardware removal. One occurred at 6 weeks following initial stabilization with 2 syndesmotic screws. Postoperative radiographs from 3-5 weeks demonstrated a progressively retrograding distal syndesmotic screw, where the proximal syndesmotic screw remained intact alongside an anatomic mortise. At the latest follow-up, this patient had an AOFAS score of 100. Another not in the AOFAS group underwent removal of a lateral plate at 4 months following the index procedure. The remaining 5 occurred well after the postoperative course at a mean of 14.2 months (7-22 months).

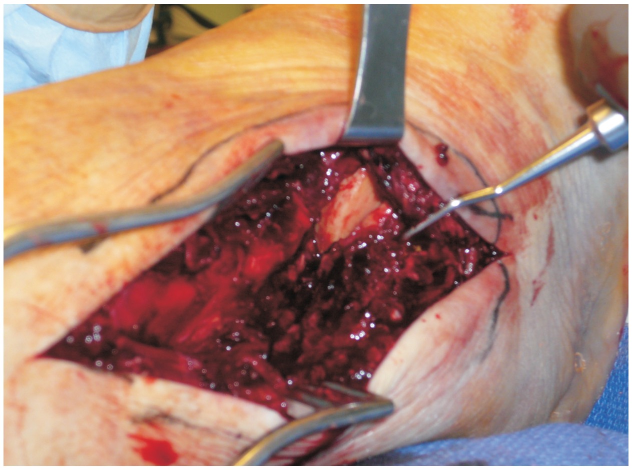

Figure 6. Weber B fracture with hemarthrosis and chondral delamination along the entire lateral shoulder of the talus.

There were no instances of complex regional pain syndrome or deep infections. There was 1 deep venous thrombotic episode. There was 1 delayed wound healing as a result of a superficial infection that completely resolved with local care and oral antibiosis at 28 days.

DISCUSSION

In one of the earliest studies investigating this concept, Tornetta et al sought to determine if overtightening the syndesmosis was possible (8). The study involved the comparison of ankle range of motion in open chain before and following placement of a 4.5 mm lag screw across the syndesmosis. The investigation was based on the historic premise that because of the unique anatomy of the talar trochlear, which is wider anteriorly than posteriorly, syndesmotic screws should be placed with the ankle in dorsiflexion to prevent restrictive ankle kinematics. The concern however lies with potential risk of malreduction since the fibula externally rotates when the talus dorsiflexed (2). Despite their findings that ankle dorsiflexion was not restricted with syndesmotic compression, the authors still discouraged the use of lagged fixation across the syndesmosis.

The presence of posterior malleolar fractures has been associated with poorer outcomes. Stufkens et al demonstrated that only 58% of ankle fractures with posterior malleolar fractures had good to excellent outcomes 4 years post injury (15,16). Furthermore the retromalleolar apporach involving dissection and retraction of the flexor hallucis longus can result in an indeterminable amount of scar tissue formation during convalescence that can result in ankle stiffness.

The ankle capsule is torn during the rotational mechanism of the injury and at times with inatrogenic insult. The healing of this capsule occurs under a reparative pathway that involves replacement with scar tissue, which histologically lacks the elasticity of the native tissue. The generation and abundance of this is under gene expression and individualized (17). Indeed, it is not unreasonable to believe that this variability can confere undesired stiffness.

The ankle fracture and syndesmotic injuries occur in closed chain. Under these circumstances, the plafond internally rotates and torques on the fully loaded trochlear of the talus. The incidence of cartilagenous injury even if macroscopically invisible is likely higher than reported (Figure 6). Hepple et al reported on the utilization of arthroscopy and reported incidences of 60-75% of intraarticular injury (5). Yoshimura et al reported chondral injury in all 4 of their cases (18). One of these presented with partial thickness fissuring of the cartilage <50% of its thickness and 3 presented with full chondral injury down to subchondral bone. Loren et al similarly reported 63% of traumatic articular injuries in their cohort, 19 of which were located on the talus and 11 on the tibia (19). Indeed the relative unpredictability of chondral healing of the talus has been elucidated (20). However Loren et al's report of chondral tibial lesions points to another interesting confounder in outcomes, as tibial lesions are notoriously associated with poor outcomes (21). Even beyond the chondral injury itself, arthrofibrosis native to the reparative process can similarly worsen ankle stiffness (22).

Syndesmotic malreduction is another variable that can influence the outcome of these ankle injuries. In their 68 cases, Sagi et al reported that of the 13 who underwent direct open visualization and the 55 who underwent closed and indirect repair of their syndesmotic injury, 2 and 24 respectively presented with malreductions on CT visualization (23). They also found that patients with malreductions presented with poor functional outcomes and further recommended that CT evaluation of the contralateral limb and the postoperative reduction would help improve outcomes. Gardner et al reported a syndesmotic malreduction rate of 52% when subsequently evaluated on CT (24). Indeed, despite our best efforts, the 2-dimensional radiographic evaluation of the syndesmosis has little bearing on the true anatomic reduction as subtle sagittal plane malreductions and difficult to evaluate coronal plane rotation of the reduction can routinely occur (23, 25-31). Certainly in instances where the transmalleolar axis is not appreciated, the syndesmosis can also be malreduced (32).

Darwish et al applied a relatively novel approach to the effects of compression across the syndesmosis. The study investigators transected the syndesmotic ligaments and inserted a pressure sensor within the incisura. When the bone tenaculums were then placed along the transmalleolar axis and clamped to simulate reduction, the pressure monitor registered 61 N. Following placement of a positional 3.5-mm cortical screw and release of the bone tenaculum, the pressure sensor reading dropped to 23 N. Conversely, the 3.5-mm and 4.5-mm cortical lag screws placed, maintained the compressive effect initially achieved. Indeed the physiologic implications of this approach are theoretical, however, the crux of their investigation demonstrated that the positional screw was unable to maintain even a third of initial the compression achieved by the bone tenaculum (1).

Our study has multiple weaknessnes. We performed no null hypothesis because we were unable to evaluate a significant percentage of our initial population and furthermore we presented no control group in order to compare the effects of positional transfixation. We did no investigation of the effects of stainless versus titanium. However, the literature elucidates no statistically significant diference in this regard (12).

There were no recent followup radiographs in our patient population who completed our AOFAS questionnaire to acertain the fate of the ankle joint. And furthermore, the reliabilty of the objective components of the AOFAS scoring system itself is not as validated or standardized (33). However, because it has been used for many of the previous studies, we sought to employ it as well in order to allow for relative comparison. Nonetheless, the rationale behind this thought and approach is fundamentally flawed. And although we referred to instances of clinically good motion, we included no actual measurements in the study. We were unable to objectively standardize the amount of force needed to reproduce a measurable and quantifiable amount of dorsiflexion, thus we focused on clinical, macroscopic, and patient's subjective accounts regarding their perceived restrictions and motion. Under this assumption, we also sought to prioritize patient subjective reports because the objective absence of 10° of dorsiflexion may be normal for one patient and not the other. Despite our best attempts, comparison of motion in the contraleral uninjured limb is based on the educated assumption that the involved limb, prior to injury had the exact same kinemantics, indeed an educated guess at best but still a guess nonetheless. And most importantly a significant portion of our population was lost to followup. The study investigators were not blinded to the outcome of the study, which potentially lends significant bias.

We performed no comparison or additional statistical analysis of the AOFAS scores regarding the utilization of lagged syndesmotic fixation because it was not ultimately our attempt to coerce our readers into necessarily adopting this technique. There are a host of reasons that can cause stiffness and confound outcomes in these injuries. The deleterious effects of syndesmotic compression have been theorized but have never truly been substantiated. In our cohort, we sought to demonstrate that since all these patients underwent lag syndesmotic compression, based on the historical premise, none should have good range of motion. These were certainly not our findings (Figure 7).

Though we saw no specific association with injury mechanism and outcome, we similarly noticed no specific detrimental outcome associated with the lagged syndesmotic screw as we saw a mixture of patients with good and poor outcomes despite the utilization of the lagged syndesmotic fixation. The results of this observational investigations could help guide the development of additional randomized controlled trials and prospective studies on appropriate recommendations on tibiofibular syndesmotic stabilization when indicated.

Figure 7. Weightbearing dorsiflexion view of a patient who underwent open reduction and internal fixation of a Weber B bimalleolar equivalent with lag syndesmotic screw fixation.

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