Original Article

Evaluation of the syndesmotic-only fixation for Weber-C ankle fractures with syndesmotic injury

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Abstract

Background: With the length of the fibula restored and the syndesmosis reduced anatomically, internal fixation using a plating device may not be necessary for supra-syndesmotic fibular fractures combined with diastasis of inferior tibio-fibular joint. A retrospective observational study was performed in patients who had this injury pattern treated with syndesmosis-only fixation.

Materials and Methods: 12 patients who had Weber type-C injury pattern were treated with syndesmosis only fixation. The treatment plan was followed only if the fibular length could be restored and if the syndesmosis could be anatomically reduced. Through a percutaneous or mini-open reduction and clamp stabilization of the syndesmosis, all but one patient had a single tricortical screw fixation across the syndesmosis. Patients were kept non-weight-bearing for 6 weeks, followed by screw removal at an average of 8 weeks. Outcomes were assessed using an objective ankle scoring system (Olerud and Molander scale) and by radiographic assessment of the ankle mortise.

Results: At a mean follow-up of 13 months, the functional outcome score was 75. Excellent to good outcomes were noted in 83% of the patients. Ankle mortise was reduced in all cases, and all but one fibular fracture united without loss of fixation. Six patients had more than one malleolar injury, needing either screw or anchor fixations. One patient had late diastasis after removal of the syndesmotic screw and underwent revision surgery with bone grafting of the fibula. This was probably due to early screw removal, before union of the fibular fracture had occurred.

Conclusion: We recommend syndesmosis-only fixation as an effective treatment option for a combination of syndesmosis disruption and Weber type-C lateral malleolar fractures.

Key words: Weber type-C ankle fractures, syndesmotic disruption, syndesmosis-only fixation, functional outcomes

Introduction

Inferior tibiofibular syndesmosis injuries occur in approximately 10% of all patients with ankle fractures.[1] The most common mechanism of injury is usually an external rotation twisting force that causes the talus to rotate externally in the mortise, leading to sequential disruption of the syndesmotic ligaments. This can be associated with a syndesmotic-level (Danis-Weber type B injury) or supra-syndesmotic level (Danis-Weber type C injury) fracture of the fibula.

Following an ankle fracture with syndesmotic disruption, accurate restoration of the ankle mortise and stable fixation of the disrupted syndesmosis are essential for optimum functional outcomes.[2,3] Though there have been numerous methods described in literature for stabilizing the syndesmosis, the conventional syndesmotic screw remains the most popular.[4] Despite being one of the commonest fractures encountered, there appears to be no consensus on the optimal method of syndesmosis fixation and the subsequent followup management.[5–8] This is particularly relevant for high fibular fractures (Weber type-C type). If the fibular fracture is above the level of the distal tibiofibular joint, this syndesmosis is assumed to be disrupted. Traditionally, all such syndesmotic injuries were internally fixed. However, recent studies have clarified that a diastasis screw should be used if the fibular fracture is more than 3.5 cm above the top of the syndesmosis. When a medial malleolar fracture has been rigidly repaired a diastasis screw is required if the fibular fracture is more than 15 cm above the syndesmosis. Is recommended only for fractures of the

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fibula that are >3.5 cm above the ankle joint if the deltoid ligament is ruptured, and 15 cm above the ankle joint if there is a concomitant fracture of the medial malleolus.[2,9]

Although the indications for trans-syndesmotic screw are now better defined, the role of internal fixation of the fibula in an associated supra-syndesmotic fibular fracture is not very clear. When the fibular fracture is located in the middle or proximal one-third of the diaphysis, operative intervention to fix the fracture is fraught with the problems associated with doing an additional procedure. If the syndesmosis can be anatomically reduced and if a stable fixation is achievable, internal fixation of the fibula may not be required. The aim of this paper is to present a series of such patients managed in this manner and to report the outcome.

Materials and Methods

Twelve patients with supra-syndesmotic fibular fractures associated with distal tibiofibular syndesmotic disruption were managed with syndesmosis-only fixation and were retrospectively reviewed for their functional and radiological outcome. All procedures were performed between April 2007 and September 2008 at a University Hospital's tertiary trauma center. Data was collected regarding patient demographics, injury mechanics, and the functional and radiological outcome at followup. The patients with other associated injuries, delayed presentation or diagnosis (beyond 6 weeks), open ankle fractures, followup less than 6 months, and incomplete clinical notes or radiographs were excluded from the study group.

All patients had initial trauma management of ankle fracture with plaster immobilization, analgesia, and elevation. Once the soft tissue swelling had subsided sufficiently, the patients were screened under fluoroscopy in the operation theatre. Syndesmotic disruption was confirmed with the external rotation stress test and/or the Cotton 'hook test.' At surgery, as the first step, the medial ankle structures were internally fixed as the situation demanded. The treatment plan was followed only if the fibular length could be restored and if the syndesmosis could be anatomically reduced [Figure 1a and b]. Through a mini-open reduction and clamp stabilization of the syndesmosis, a single tricortical 3.5-mm cortical screw was inserted across the syndesmosis approximately 2 cm above the tibiotalar joint line, according to the AO principles of fracture management. One ankle had a single quadricortical screw fixation. One ankle had a posterior malleolar fracture large enough (>25% of the articular surface) to require screw fixation.

Postfixation stability of the syndesmosis and the reduction of the fracture were checked clinically and by fluoroscopy on the operating table. All patients received below-knee plaster immobilization. They were first seen in the outpatient clinic at 2 weeks for wound inspection and removal of skin sutures. At this point, a removable plaster cast was provided to enable gentle movements of the ankle joint out of the cast. Patients who were considered likely to be non-compliant were left with the cast for the full 6 weeks. Non-weight-bearing mobilization using crutches was strictly advocated for 6 weeks. At the 6 weeks' followup appointment, clinical evidence of fracture healing along with radiological findings of a stable well-reduced ankle mortise and a healing fracture, would determine the optimum time for removal of the syndesmotic screw. Patients were then allowed to mobilize partial weight bearing using a pneumatic walking brace or a walking cast till the removal of the syndesmotic screw, which was performed at an average of 8 weeks. All patients were also formally referred to our physiotherapy department for regaining ankle movements under supervision.

Figure 1: X-ray lower third leg bones with ankle joint (anteroposterior and lateral view) showing (a) pre-reduction Weber type-C ankle fracture with syndesmotic disruption (b) post reduction X-ray with syndesmotic screw

A radiographic assessment of the ankle was done at the latest followup. An objective ankle scoring system (OMAS - Olerud and Molander ankle scale)[10] was distributed to the patients and collected by post. The OMAS is a self-administered patient questionnaire. The scale is a functional rating scale where the score can range from 0 (totally impaired) to 100 (completely unimpaired). It is based on nine different items: pain, stiffness, swelling, stair climbing, running, jumping, squatting, supports, and activities of daily living. Scores of 91–100 were graded as excellent results, 61–90 as good, 31–60 as fair, and 0–30 as poor.

Results

The average age of patients was 35 years (range 20–48 years). Fifty-eight percent (n=6) of the subjects were male. The right to left ratio was 1:3. The mechanism of injury was accidental twisting falls in eight patients, sports-related in three, and road traffic accident in one case. One fracture dislocation was manipulated in the emergency setting before further definitive management. Nine fractures were in the middle third of the fibula and the other three were Maisonneuve fractures [Figure 2a–c]. Ten fractures were pronation–external rotation (PER) injuries according to the Lauge-Hansen classification (stage 3 PER in eight ankles and stage 4 PER in four ankles) and two were of pronation–abduction type. Medial malleolar screw fixation was performed in six ankles and a deltoid ligament anchor used in one case.

At an average followup of 13 months (range 7–21 months), functional outcome using the OMAS was 75. Four patients (33%) had excellent outcome, six patients (50%) a good outcome, and two patients (17%) had a fair outcome. The ankle mortise was reduced in all cases except one [Figure 3a, b]. In this latter patient the syndesmotic screw removed at 8 weeks, resulting in late diastasis. The fibula was found to be in non-union and she required revision surgery with bone grafting and internal fixation of the fibula. One patient with trimalleolar fracture had residual ankle stiffness, which responded to intensive physiotherapy. None of the syndesmotic screws broke.

Figure 2: (a) Stage 4 PER Maisonneuve fracture with syndesmosis failure: pre- and post-fixation (b) Ankle radiograph of the same patient showing medial malleolar fracture and no inferior tibio-femoral overlap (b,c) Post-operative radiograph with the medial malleolus fixed and syndesmosis stabilised with trans-syndesmotic screw

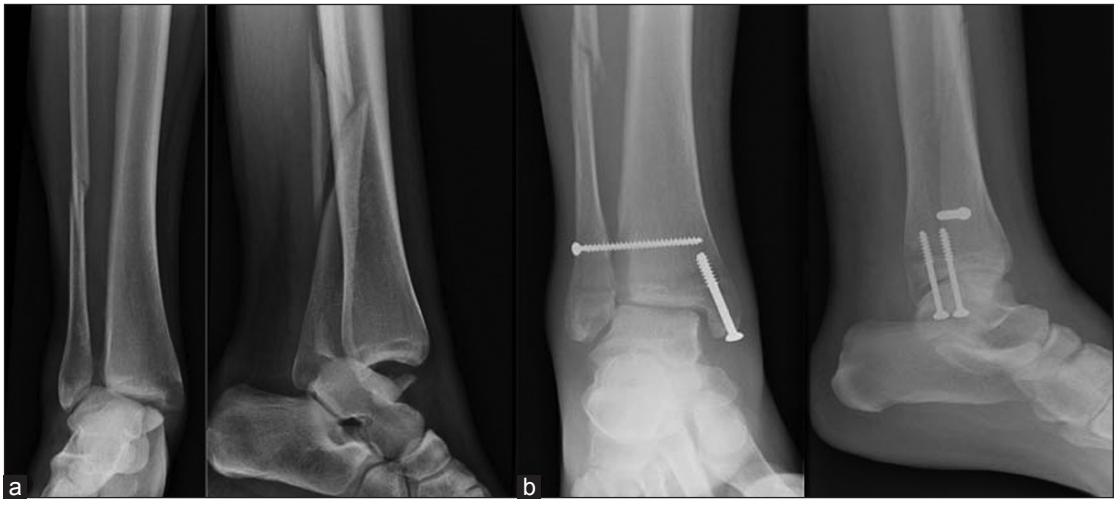

Figure 3a,b: Bimalleolar ankle fracture treated with syndesmosis-only fixation; the post-fixation X-ray at 7 weeks shows imperfectly reduced syndesmosis and inadequate healing of the fibular fracture. This patient had late diastasis after screw removal

Discussion

Numerous clinical studies have shown that the single most important predictor of good functional outcome of ankle fractures with syndesmotic injury is the anatomic reduction of the syndesmosis.[2,3,11] Regaining the fibular length and achieving the correct rotation of the fibula relative to the tibia are absolutely vital for restoration of the proper tibiofibular relationship. Computed tomography evaluation of external rotation–type ankle fractures have shown the rotation of the fibular fragments in relation to one another and also in relation to tibia.[12,13] What they have clearly demonstrated that the distal fibular fragment rotates externally relative to the proximal fibular fragment. Hence, in order to achieve reduction of the fibula in the proper anatomical relationship to the tibia at the syndesmosis, the reverse movement (internal rotation of the distal fibular fragment) should be used.

Accurate restoration of fibular length can be achieved with open anatomic reduction and stable fixation of the fibula. However, in proximal and mid-diaphyseal fibular fractures, internal fixation involves the risks associated with additional soft tissue dissection, chance of injury to the common peroneal nerve, and difficulty using metalwork above the fracture in the proximal third of the fibula.[14,15] In this case, the fibular length and rotation may be restored without internal fixation of the fracture but, indirectly, by accurate and stable fixation of the syndesmosis. We made the decision to proceed with syndesmosis-only fixation based on the preoperative identification of the fibular fracture at a relatively high level and intraoperative assessment of ability to restore the fibular length and accurately reduce the mortise. Any situation where it was not possible to achieve these (for example, due to delayed presentation) would render this method of fixation as not being ideal.

Accurate assessment of length and rotation is possible with intraoperative imaging of the involved ankle joint. The medial clear space, tibiofibular overlap, and tibiofibular clear space need to be accurately restored in the mortise view.[16] The dense subchondral bone of the distal tibia should be at the same level as a small spike seen on the fibula, with an unbroken Shenton line of the ankle.[17] It would be wise to get lateral imaging of the ankle as well and comparison views of the normal ankle to achieve the required result. We find the medial clear space the easiest radiological assessment to interpret.

Though this might be a common method of treatment utilized by many surgeons, to the best of our knowledge there has not been a clinical study looking at outcomes resulting from not fixing a fibular fracture associated with syndesmotic injury. In a cadaveric study, Ho *et al*.[18] recreated an injury pattern of midshaft fibular fracture with syndesmotic and deltoid ligament disruption. They attempted to determine whether syndesmotic fixation alone or syndesmotic fixation with addition of a fibular plate would impart better biomechanical properties. The study found that the rotational stability, load to failure, and stiffness would be significantly higher with the plate and syndesmotic fixation repair technique than with the syndesmotic fixation–only technique. Though there may be better stability of plated mid-diaphyseal fibular fractures, the risks of an additional procedure, with possible wound and neurovascular complications, need to be taken into account as well. In a case profile of a supra-syndesmotic stage 4 PER injury reported by Saltzman,[19] one author argues that syndesmotic fixation alone will restore the length and rotation of the distal fibular segment, thereby achieving a congruent ankle mortise. In addition it will provide a buttress against lateral talar subluxation. The argument was that internal fixation of such diaphyseal fibular fractures is associated with risks (infection, neurological damage, prominent metal work, peroneal tendonitis, nonunion and delayed union, hardware failure, prominent metal work, etc.) that outweigh the benefits.

The one complication in our study was late diastasis of the syndesmosis following screw removal after 8 weeks. In retrospect, it is clear that the fibula was not radiologically united at the time of screw extraction. Ebraheim *et al.*[20] have advised that the syndesmotic screw should not be removed till the fibular fracture shows signs of healing, especially in cases with deltoid ligament injury. Their series of internal fixation of 32 supra-syndesmotic ankle fractures had a 6% rate of delayed union and 13% rate of nonunion.

Our study has limitations in that it is a retrospective observational analysis, involving a small study cohort and with a relatively short followup. However, to our knowledge, there are no previous reports in the literature regarding the outcomes of syndesmosis-only fixation.

We recommend syndesmosis-only fixation as an effective method of treatment when confronted with a combination of syndesmosis disruption and Weber type-C lateral malleolar fractures. In our opinion, restoration of the fibular length, anatomical reduction of the syndesmosis are essential for a successful outcome.

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