Long-term Results After Ankle Syndesmosis Injuries

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Abstract

Syndesmotic disruption occurs in more than 10% of ankle fractures. Operative treatment with syndesmosis screw fixation has been successfully performed for decades and is considered the gold standard of treatment. Few studies have reported the long-term outcomes of syndesmosis injuries. This study investigated long-term patient-reported, radiographic, and functional outcomes of syndesmosis injuries treated with screw fixation and subsequent timed screw removal. A retrospective cohort study was carried out at a Level I trauma center. The study group included 43 patients who were treated for ankle fractures with associated syndesmotic disruptions between December 2001 and May 2011. The study included case file reviews, self-reported questionnaires, radiologic reviews, and clinical assessments. At 5.1 (±1.76) years after injury, 60% of participants had pain, 26% had degenerative changes, 51% had loss of tibiofibular overlap, and 33% showed medial clear space widening. Retained syndesmotic positions on radiographs were linked to better self-reported outcomes. There is an inversely proportional relation between age at the time of injury and satisfaction with the outcome of the ankle fracture as well as a directly proportional relation between age at the time of injury and pain compared with the preinjury state. Optimal restoration and preservation of the syndesmosis is crucial. Syndesmotic disruption is associated with poor long-term outcomes after ankle fracture. Greater age is a risk factor for chronic pain and dissatisfaction with the outcome of ankle fracture and syndesmosis injury. Therefore, patient education to facilitate realistic expectations about recovery is vital, especially in older patients. [Orthopedics. 2015; 38(11):e1001-e1006]
Ankle fractures are among the most common injuries of the lower limbs.\(^1\) Associated disruption of the syndesmosis occurs in more than 10% of these fractures.\(^1,2\) The syndesmotic complex tightly connects the distal tibia and fibula to create a firm mortise for articulation of the talar dome and tibia. Syndesmotic injuries involve rupture of 1 or more ankle-stabilizing ligaments. The mechanism of injury is hyperdorsiflexion and external rotation of the ankle.\(^3\) Anatomic reduction and adequate fixation of the distal tibiofibular joint and syndesmosis are considered essential\(^4\) because instability, syndesmotic widening,\(^5\) and talus shift have been linked to poorer functional outcomes and posttraumatic ankle osteoarthritis.\(^6-9\)

Operative treatment with syndesmosis screw fixation has been successfully performed for decades and is considered the gold standard of treatment.\(^10\)

Only a few studies have reported the long-term outcomes of syndesmosis injuries.\(^11,12\)

Although routine screw removal before weight bearing is common practice, the optimal time for screw removal has not been consistently reported.\(^13\) It has been suggested that screw removal earlier than 8 weeks postoperatively can lead to loss of anatomic reduction.\(^4\) Possible problems associated with failure to remove screws before weight bearing are lack of ankle joint motion (synostosis/osteolysis) and screw loosening or breakage.\(^10\) Functional consequences of screw loosening or breakage are controversial.\(^13\)

The goal of this study was to investigate the long-term outcome of syndesmosis injuries treated with screw fixation and subsequent screw removal. The study also compared the long-term outcome of syndesmosis screw removal within 2 months postoperatively with removal at approximately 3 months.

**Materials and Methods**

This cohort study was conducted at a Level I trauma center. Before the start of the study, approval was obtained from the local human research ethics committee.

All patients who were admitted with ankle fractures requiring syndesmosis fixation between December 2001 and May 2011 were identified by the hospital coding system. Patients included in the study were treated for any type of distal tibiofibular fracture with associated syndesmotic disruption or articular widening; required syndesmosis fixation; were 18 years or older at the time of study follow-up; were able to attend the outpatient clinic for follow-up; and were able to give voluntary informed consent. Excluded from the study were those who were younger than 18 years at the time of study follow-up; those who were unable to give informed consent; those who were unable to attend the outpatient clinic for follow-up because of large geographic distances; and those who had screw removal that was not completed according to the protocol.

Syndesmotic disruptions were diagnosed preoperatively by clinical examination and radiographic investigation of tibiofibular overlap and widening of the tibiofibular clear space. Disruption was confirmed intraoperatively with the Hook test.\(^14,15\)

Syndesmoses were stabilized with 1 or 2 screws, had 3 or 4 cortices, and were 3.5 or 4.5 mm. This choice of procedure was based on the preference of the surgeon, reflecting the nature of a university teaching hospital. As is common in large teaching hospitals, ankle and syndesmosis repairs were performed by surgeons with different levels of training. Syndesmosis screw fixation was done with the ankle in a neutral position. After operative fixation, patients were immobilized in a below-knee cast with the ankle in a neutral position without weight bearing for 6 weeks, followed by weight bearing as tolerated until screw removal.

For participants treated between December 2001 and February 2009, the timing of syndesmosis screw removal had not been specified, and screws were removed at 2 and 3 months, with most removed 2 months postoperatively. After 2009, screws were left in place for 3 months and removed immediately before full weight bearing. This 2009 change in clinical protocol allowed for comparison of early and late screw removal. Two homogeneous groups were formed.

Eligible patients were invited to attend the outpatient clinic for a final follow-up visit that consisted of functional and radiographic assessments as well as self-reported questionnaires. All participants provided voluntary informed consent to take part in the study.

**Radiologic Examination**

Standard anteroposterior, lateral, and mortise radiographs of the affected ankle were taken at final follow-up for comparison with previous images. These images were interpreted by a certified radiologist. The goal was to detect changes in syndesmotic width and medial clear space and degenerative changes in tibiofibular joints and joint alignment. Syndesmotic width was determined by measuring the medial clear space and tibiofibular overlap 2 cm\(^15\) above the tibia plafond joint line.

**Clinical Examination**

The figure-of-eight method was used to measure calf and ankle circumference.\(^16,17\) Dorsiflexion, planter flexion, inversion, and eversion were measured with a goniometer. Inversion and eversion were measured in the prone and sitting positions without weight bearing. All measurements were compared with the contralateral side.

**Subjective Outcomes**

Patient satisfaction with the outcome of ankle fracture and syndesmosis injury, pain, and difficulty with activities of daily living were measured with the visual analog scale and the Foot and Ankle Outcome Score (FAOS).\(^11,18\) The FAOS assesses the patient’s opinion on a variety of problems with the foot and ankle. The score ranges...
from 0 to 500, with higher scores indicating better function. The European Quality of Life-5 Dimensions (EQ-5D) score was used as a standardized instrument to measure health outcome. Different categories are rated from 1 to 5, with lower scores indicating better health. Permission to use this score was provided by the EuroQol Group Foundation.

Statistical Methods

For data analysis, SPSS version 20.0 software (SPSS Inc, Chicago, Illinois) was used. P<.05 was considered statistically significant. Fisher’s exact test was used to compare overall outcomes. Analysis of variance (regression coefficient) was used to investigate the correlation between age and FAOS, EQ-5D, and visual analog scale as well as the correlation between syndesmotic widening and FAOS and EQ-5D.

To assess outcomes after screw removal at 2 months (7.9±0.9 weeks) vs 3 months (12.4±0.3 weeks), variables were compared with mean values and proportions. Student’s t test was used to compare values between each group to measure statistical significance.

RESULTS

Sixty-six patients met the inclusion criteria for study enrollment. Forty-three attended the orthopedic outpatient clinic for a follow-up visit (Figure 1). Subjective (patient-reported questionnaires), radiographic, and functional long-term outcomes were reviewed. Patient demographics are shown in Table 1.

Analysis of patient-reported questionnaires showed that EQ-5D scores were poorest in the category of pain/discomfort, with 60% (26 of 43) of patients still reporting pain a mean of 5.1 (±1.76) years after injury. In contrast, FAOS results were poorest in the category of quality of life.

Radiographic results after 5 years showed that 26% (11 of 43) of patients had degenerative changes. Fifty-one percent (22 of 43) of patients showed some degree of loss of tibiofibular overlap (increase in widening compared with the initial radiograph image). The loss of overlap was severe (>2 mm increase) in 16 of these 22 cases. Thirty-three percent (14 of 43) of patients showed medial clear space widening.

Clinical examination showed a high incidence of limitation of range of motion in the operated ankle compared with the contralateral ankle (Table 2). Fifty-one percent (22 of 43) of patients had restrictions in dorsiflexion-plantar flexion, and 58% (25 of 43) of patients had restrictions in inversion-eversion.

A trend in correlations was found between the change in syndesmotic width and the results of self-reported questionnaires. Participants with retained syndesmotic reduction scored higher in all FAOS categories except for function, sports and recreational activities. Likewise, the EQ-5D showed better scores in all categories except mobility when reduction was retained (Figures 2-3).

The effect of age on FAOS, EQ-5D, and visual analog scale scores was investigated. Significant correlations were

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**Table 1**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total (n=43)</th>
<th>2-Month Group (n=17)</th>
<th>3-Month Group (n=26)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Follow-up time, mean (SD), y</td>
<td>5.1 (1.76)</td>
<td>6.3 (1.58)</td>
<td>4.4 (1.80)</td>
</tr>
<tr>
<td>Age, mean (SD), y</td>
<td>42 (16)</td>
<td>44 (19)</td>
<td>42 (14)</td>
</tr>
<tr>
<td>Dislocation, No.</td>
<td>23</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>Time until screw removal, mean (SD), wk</td>
<td>10.62 (2.30)</td>
<td>7.88 (0.94)</td>
<td>12.41 (0.30)</td>
</tr>
<tr>
<td>Classification, No.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weber A</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Weber B</td>
<td>12</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Weber C</td>
<td>23</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

**Table 2**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call difference, cm</td>
<td>0.0 (1.79)</td>
</tr>
<tr>
<td>Ankle difference, cm</td>
<td>1.0 (0.98)</td>
</tr>
<tr>
<td>Loss of dorsiflexion-plantar flexion, deg</td>
<td>3.3° (16.8°)</td>
</tr>
<tr>
<td>Loss of inversion-eversion, deg</td>
<td>6.4° (16.8°)</td>
</tr>
<tr>
<td>Loss of inversion-eversion in prone position</td>
<td>4.2° (14.0°)</td>
</tr>
</tbody>
</table>
found between age and the FAOS categories of function, sports and recreational activities (reflection coefficient [RC]=-0.31; \( P=.045 \)) and function, daily living (RC=-0.47; \( P=.009 \)); the EQ-5D category of mobility (RC=0.49; \( P=.001 \)); and the visual analog scale categories of satisfaction (RC=0.64; \( P=.012 \)) and pain (RC=0.58; \( P=.004 \)) (Figure 4).

No significant correlations were found between age and radiologic or functional outcomes (\( P>.05 \)).

Screw breakage occurred in only 2 patients. Both were young men and were treated with 3.5-mm screws that were removed 3 months after injury, as per protocol. The effect of syndesmosis screw removal after 2 or 3 months on ankle arthritis and instability was investigated with multiple variables. No relevant statistically significant differences between the 2 groups were found.

Figure 5 shows the radiologic outcome of 2 cases, showing satisfactory vs poor results.

**Discussion**

This study investigated the effect of syndesmosis injuries associated with ankle fractures on long-term patient-reported, radiographic, and functional outcomes.

When these results were compared with the most comparable normal population, the EQ-5D score showed that the study population had 3 times more problems with mobility and 2.5 times more problems with personal care. The study population also had 2.9 times more problems with usual activities (eg, work, study, housework, family or leisure activities), 2 times more pain/discomfort, and 1.5 times more anxiety/depression than the normal population (Figure 6). Ratings of overall health did not differ from the normal population. Figures are presented to be comparable to the normal data set.
The demonstrated correlations between syndesmotic width and patient-reported questionnaires have clinical relevance. Accurate syndesmotic reduction and maintenance or improvement of joint position results in better patient-reported outcomes (Figures 2-3). These findings are consistent with previous reports, although they were not statistically significant in the study population. Correlations were found between age and various other variables. Some are unlikely to be related to the ankle injury. For example, difficulties with sports and mobility are common in elderly people. However, others must be considered highly relevant. The fact that older people report more difficulties with activities of daily living, more pain compared with the preinjury state, and less satisfaction with the outcome of ankle fracture and syndesmosis injury suggests that greater age is a risk factor for poorer outcomes (Figure 4). To ensure realistic expectations for recovery after syndesmosis fixation, patients should be informed by the surgeon that ongoing problems are to be expected. Screw breakage was very rare in the study population, possibly because of the routine screw removal before full weight bearing. No complications or unfavorable outcomes arose from the 2 breakages reported in the study population. This finding is in keeping with earlier reports that showed that retention of loose or broken screws does not lead to worse outcomes.

Consistent with the findings of Hsu et al., the current study found no relevant significant differences between screw removal at 2 months vs 3 months. Earlier screw removal was not associated with syndesmotic malreduction or poorer functional and patient-reported outcomes. Therefore, if screw removal before weight bearing is considered necessary, removal 2 months postoperatively could be considered to prevent the likelihood of prolonged immobilization and delayed return to work. The use of more modern techniques and devices, such as suture buttons instead of screw fixation, also allows safe early weight bearing and rapid return to work.

Limitations

This study had some limitations. Operative procedures were performed by surgeons with different levels of training. However, this is a real-life situation that could be anticipated in many other hospitals.

Small differences in angles of anteroposterior radiographic images affected the accuracy of measurements and analysis of radiographs. Plain radiographs were somewhat difficult to assess. To ensure accuracy, measurements were taken by 2 researchers independently; means were used. The use of computed tomography could likely improve accuracy. Sagi et al. recommended routine postoperative bilateral computed tomography scans of syndesmoses, and this study showed considerably fewer malreductions and better outcomes after 2 years.

With the number of available participants, statistically significant differences could not be shown between screw removal after 2 months vs 3 months. Because of the small sample size, statistical power may not have been strong enough. No post hoc power analysis was conducted because its usefulness is controversial.

Conclusion

The study findings showed that syndesmotic disruptions can have clear negative effects on long-term functional and overall outcomes after ankle fracture. Most patients reported pain after a mean of 5.1 years. Greater age at the time of injury was a risk factor for chronic pain and dissatisfaction with the outcome of ankle fracture and syndesmosis injury. More accurate syndesmotic reduction and maintenance or improvement of joint position leads to better outcomes. Therefore, optimal restoration and preservation of the syndesmosis is considered crucial. Outcomes after syndesmosis injuries are frequently worse than predicted, especially in older people. Patient education to facilitate realistic expectations about recovery is vital.

References


