Isolated Syndesmosis Ankle Injury

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abstract

Isolated syndesmosis injuries often go unrecognized and are diagnosed as lateral ankle sprains; however, they are more disabling than lateral ankle sprains. The reported incidence of isolated syndesmosis injuries in acute ankle sprains ranges between 1% and 16%. When ankle disability lasts for more than 2 months after an ankle sprain, the incidence increases to 23.6%. Diagnostic workup may include stress radiographs, magnetic resonance imaging, or diagnostic arthroscopy. A simple stress test radiograph may reveal an unstable grade III syndesmosis sprain that may go unrecognized on plain anteroposterior and mortise or lateral radiographs of the ankle. The duration of symptoms in isolated syndesmosis injury is longer and more severe, often leading to chronic symptoms or ankle instability requiring operative stabilization.

This article describes the clinical presentation, injury classification, and operative stabilization techniques of isolated syndesmosis injuries. The authors performed their preferred operative stabilization technique for isolated syndesmosis injury—arthroscopic debridement of the ankle with syndesmotic stabilization with a syndesmotic screw—in 4 patients. All patients were evaluated 1 year postoperatively with subjective and objective assessment scales. Three of 4 patients showed good improvement of general subjective ankle symptoms and subjective ankle instability rating and a high Sports Ankle Rating System score after 1 year.

Figure 1: Intraoperative photograph showing the ruptured anterior syndesmosis.

Figure 2: Intraoperative photograph showing the placement of the syndesmotic screw.
The classification of ankle fractures into rotational and angular components by Lauge-Hansen\(^1,2\) is widely accepted. The Lauge-Hansen classification describes the various osseous and ligamentous injuries of the ankle caused by an ankle sprain. Syndesmosis injury can occur through different injury mechanisms and is often accompanied by an ankle fracture.\(^1\) A syndesmosis injury is caused most commonly by external rotation of the foot,\(^3,6\) evasion of the talus within the ankle mortise,\(^4,6\) or excessive dorsiflexion.\(^3,5,6\)

Isolated distal tibiofibular syndesmosis rupture was first described by Wilson et al\(^7\) in 1939. It is also referred to as a syndesmosis sprain or high ankle sprain. According to Lauge-Hansen,\(^1,12\) an isolated anteroinferior tibiofibular ligament rupture is a ligamentous fracture or stage I of a supination–eversion fracture.

The reported incidence of isolated anteroinferior tibiofibular ligament ruptures in acute ankle sprains ranges between 1% and 16%.\(^5,8-14\) When ankle disability lasts for more than 2 months after an ankle sprain, the incidence increases to 23.6%.\(^15\)

This article describes the classification of isolated anteroinferior tibiofibular ligament injuries and operative stabilization techniques.

**Materials and Methods**

**Patient Demographics**

Three women and 1 man presented to the authors’ outpatient clinic with a suspicion of isolated anteroinferior tibiofibular ligament injury. Average patient age at injury was 28.8 years (range, 18–40 years). The initial diagnosis for all patients was a lateral ligament injury of the ankle. In 3 cases, the trauma mechanism appeared to be a simple rotatory accident during skiing.

Acute symptoms after trauma were pain and swelling on the anterolateral side of the ankle and an inability to bear weight. Patients initially received conservative treatment consisting of rest, ice, compression, and elevation, followed by immobilization with a soft cast when symptoms persisted. After the acute phase, patients’ symptoms persisted with pain on the anterolateral side of the ankle and perceived ankle instability. Ankle swelling was not apparent.

**Pre- and Postoperative Evaluation**

Preoperative assessment included physical examination of the ankle with special emphasis on the presence of swelling, location of pain, and stability of the ankle. Ankle stability was assessed by applying the anterior drawer stress test. The squeeze test\(^5,16\) and point test\(^6,17\) were performed to assess the syndesmosis.

Anteroposterior, mortise, and lateral plain radiographs were obtained. Additional abduction and external rotation stress test radiographs of both ankles were obtained for 1 patient. Magnetic resonance imaging (MRI) was performed for 3 patients.

All patients were evaluated with subjective and objective assessment scales at 1 year postoperatively.\(^18-22\) General subjective ankle symptoms were assessed with the rating system of Karlsson and Peterson.\(^18\) Subjective ankle instability was assessed with the rating system of Sefton et al.\(^20\) Activity level was assessed with the Tegner score.\(^19\) The Sports Ankle Rating System of Williams et al,\(^21\) consisting of the Quality of Life Measure, the Clinical Rating Score, and the Single Assessment Numeric Evaluation, was also used. The Quality of Life Measure consists of 5 subscales that assess the impact of an ankle injury on different aspects of an athlete’s life. The Clinical Rating Score uses patient-based visual analog scales and clinician-based testing to assess an athlete’s ankle-related health status. The Single Assessment Numeric Evaluation is a single-question assessment of an athlete’s perception of his or her ankle function.\(^21\)

**Surgical Technique**

Surgery was performed with the patient in a decubitus position. Cefuroxime antibiotic prophylaxis was used, preferably a half hour before initial incision. A tourniquet was applied around the upper limb. Standard anteromedial and anterolateral portals were used to perform the anterior ankle arthroscopy. After inspection, anterior debridement of the ankle and syndesmosis region was performed.

For syndesmosis stabilization, a hockey stick incision was made over the distal fibula. The anteroinferior tibiofibular ligament was assessed for instability and rupture (Figure 1). After inspection of the anteroinferior tibiofibular ligament and removal of any protrusion of ligaments or scar tissue into the inferior tibiofibular space, reposition was performed with Weber forceps. Approximately 5 cm above the tibial plafond, the syndesmatic screw was placed at a 30° angle in the anteromedial direction (Figure 2). Fluoroscopy was used to confirm the stability of the syndesmosis. The ruptured anteroinferior tibiofibular ligament was sutured with Vicryl sutures (Ethicon, Somerville, New Jersey).
Jersey) (Figure 3). A plaster of Paris cast was applied for 6 to 8 weeks, combined with nonweight bearing.

**RESULTS**

All patients had full range of motion and no apparent ankle swelling during preoperative physical examination. Pain over the anteroinferior tibiofibular ligament could be provoked by compression of the tibia and fibula above the distal syndesmosis (squeeze test) and by direct pressure on the anteroinferior tibiofibular ligament (point test). The anterior drawer stress test showed minor instability in 2 patients.

Complementary investigations were performed (Table 1). Although plain radiographs showed no abnormalities, syndesmotic instability was revealed with an abduction and external rotation stress test radiograph performed in 1 patient (Figure 4). A partial rupture of the anterior talofibular ligament and an osteochondral lesion of the talus were apparent on MRI.

Anterior ankle arthroscopy revealed scar tissue located at the ruptured anteroinferior tibiofibular ligament. The osteochondral lesion was left untreated. In 2 patients, the syndesmosis was directly stabilized with a syndesmotic screw. In the other 2 patients, only the scar tissue was debrided initially. These 2 patients later underwent syndesmotic stabilization when symptoms persisted.

After syndesmotic stabilization, the ankle was immobilized in a plaster of Paris cast for 6 to 8 weeks with nonweight bearing. The syndesmotic screw was removed after 6 to 8 weeks during an outpatient visit. After 1 year, all patients were reassessed (Table 2). Three patients showed good improvement of general subjective ankle symptoms and subjective ankle instability rating and a high Sports Ankle Rating System score. These improvements were not reflected in the pre- and postoperative Tegner scores because 2 patients continued with their sport activities despite their symptoms. One patient showed aberrant results. Despite a negative preoperative MRI, successful syndesmosis stabilization, and an objectively stable ankle at follow-up, the patient’s ankle symptoms persisted. Compared with the other patients, she had a serious anxiety disorder, restricting her activities of daily living and physical comfort. This may explain the aberrant results. However, it may also illustrate that a syndesmosis sprain is a serious injury that may result in disabling discomfort.

**DISCUSSION**

Isolated Syndesmosis Injury Classification

Scranton subdivided the duration of symptoms after traumatic syndesmosis injuries into acute (less than 6 weeks), subacute (6 weeks to 3 months), and chronic (more than 3 months). The severity of acute syndesmosis injury is rated from grade I to III by several authors, and their classifications have many similarities. A grade I injury is a partial anteroinferior tibiofibular ligament tear, and the joint is stable with a normal radiograph. Wolf and Amendola reported that exorotation and squeeze tests are negative in a grade I injury. According to Gerber et al., one of these 2 tests should be positive. Scranton reported that a grade I injury is reflected by a positive point test.

A grade II injury is a complete anteroinferior tibiofibular ligament tear, and the joint is stable with a normal radiograph. Wolf and Amendola reported that exorotation and squeeze tests are positive in a grade I injury. According to Gerber et al., one of these 2 tests should be positive. Scranton reported that a grade I injury is reflected by a positive point test.

A grade II injury is a complete anteroinferior tibiofibular ligament tear and inferior interosseous ligament tear. Radiographs are normal, and exorotation and squeeze tests are positive. In a grade II injury, the joint is stable or unstable according to Wolf and Amendola and unstable according to Scranton. Although

<table>
<thead>
<tr>
<th>Patient No./Sex/Age, y</th>
<th>Time From Injury, mo</th>
<th>Radiography</th>
<th>MRI</th>
<th>Cast Time, wk</th>
<th>Syndesmosis Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/31/M</td>
<td>To Presentation: 12</td>
<td>To Arthroscopy: 13</td>
<td>To Stabilization: 17</td>
<td>Normal</td>
<td>No</td>
</tr>
<tr>
<td>2/18/F</td>
<td>1</td>
<td>12</td>
<td>22</td>
<td>Normal</td>
<td>Yes: no abnormalities</td>
</tr>
<tr>
<td>3/40/F</td>
<td>12</td>
<td>15</td>
<td>15</td>
<td>Normal</td>
<td>Yes: partial anterior talofibular ligament rupture</td>
</tr>
<tr>
<td>4/26/F</td>
<td>2</td>
<td>6</td>
<td>6</td>
<td>Stress test radiograph: ankle instability</td>
<td>Yes: osteochondral talus lesion</td>
</tr>
</tbody>
</table>

Abbreviation: MRI, magnetic resonance imaging.
Scranton\textsuperscript{23} describes the ankle as unstable, it should not be operatively stabilized but treated with immobilization.

A grade III injury is a complete anteroinferior tibiofibular ligament tear including a (partial) interosseous ligament tear and deltoid ligament avulsion; the joint is unstable with an abnormal radiograph and positive exorotation and squeeze tests. A grade III injury requires operative stabilization.

According to this classification system, the current 4 patients had injuries consistent with syndesmotic injuries, with 3 being chronic and 1 being acute (grade III) (Table 1).

**Complementary Investigations**

When plain radiographs do not provide sufficient information, Brage et al\textsuperscript{25} advised using stress radiographs to assess the ankle for instability. This is supported by Jenkinson et al,\textsuperscript{26} who reported that intraoperative stress fluoroscopy is a valuable tool for the detection of unstable syndesmotic injuries. In contrast, Ogilvie-Harris and Reed\textsuperscript{27} reported a low specificity for stress radiographs in the detection of syndesmosis injuries. Muratli et al\textsuperscript{28} reported that stress radiography measurements of the syndesmotic region are not accurate due to individual anatomic variation. To detect subtle signs of syndesmotic instability, the current authors compared stress radiographs of the injured ankle with those of the contralateral ankle.

The use of MRI has increased over time and has completely replaced arthrography as the imaging modality of choice for the ankle. According to Muhle et al,\textsuperscript{29} when MRI is performed with the ankle in dorsiflexion, all relevant ligaments of the distal syndesmosis can be distinguished. When an injury of the distal tibiofibular syndesmosis is visualized with MRI, a substantial number of associated secondary findings exist, including anterior talofibular ligament injury, bone bruises, osteochondral lesions, tibiofibular joint congruity, and tibiofibular recess height.\textsuperscript{30} Although a syndesmosis injury was not found on the 3 MRI studies performed on the current patients, MRI revealed a concomitant partial anterior talofibular ligament rupture and an osteochondral lesion. If a contrast-enhanced MRI had been used, it would have increased the accuracy of the syndesmosis assessment. In the acute phase of a syndesmotic injury, a sensitivity of 100% and a specificity of 83% are reported for MRI.\textsuperscript{31} In the chronic phase of a syndesmotic injury, a sensitivity of 91.6% to 95.8% and a specificity of 71.4% to 76.2% are reported for MRI.\textsuperscript{32}

Because of residual ankle symptoms and a clinical suspicion for syndesmosis injury, arthroscopy was used as a diagnostic tool in the current study. Takao et al\textsuperscript{15} described the effectiveness of arthroscopy as a diagnostic tool in determining the source of disability subsequent to an ankle.

Table 2: Assessment Scales

<table>
<thead>
<tr>
<th>Assessment Scale (Worst-Best)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>General subjective ankle symptoms (0-100)\textsuperscript{18}</td>
<td>52</td>
<td>75</td>
<td>42</td>
<td>42</td>
</tr>
<tr>
<td>Subjective ankle instability rating (grade 4-1)\textsuperscript{19}</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Tegner score (level 0-10)\textsuperscript{19}</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Quality of Life Measure (0-100)</td>
<td>N/A</td>
<td>78</td>
<td>N/A</td>
<td>56</td>
</tr>
<tr>
<td>Clinical Rating Score (subjective, 0%-100%; objective, 0%-100%)</td>
<td>N/A</td>
<td>85/93</td>
<td>N/A</td>
<td>48/67</td>
</tr>
<tr>
<td>Single Assessment Numeric Evaluation (0-100)</td>
<td>N/A</td>
<td>90</td>
<td>N/A</td>
<td>50</td>
</tr>
</tbody>
</table>

Abbreviations: N/A, not applicable; Post, postoperatively; Pre, preoperatively.

Figure 4: Stress test radiographs of the right (A) and left (B) ankles. The red circle indicates a subtle widening of the left ankle’s syndesmosis.
sprain. They identified the cause in most cases that had gone undiagnosed based on physical examination and imaging studies. As described by Ogilvie-Harris and Reed, two mm or more of motion at the inferior tibiofibular joint under arthroscopy may be considered unstable.

Treatment

Different treatment protocols are described for the acute and chronic phases of syndesmotic sprains. Only 2 systematic reviews in the literature have focused on syndesmotic sprains. These reviews identified case series as the highest level of evidence available in guiding treatment of syndesmotic sprains. The case series reviewed did not use consistent methods of diagnosing or grading injury and used no uniform treatment protocols. Different stabilization techniques for syndesmosis have been described. Stabilization with a syndesmosis hook, a syndesmotic screw, ligamentoplasty; and syndesmodesis have been reported. Ogilvie-Harris and Reed treated 19 patients with persistent symptoms after syndesmotic disruption. Arthroscopic resection of the torn parts of the interosseous ligament and cartilage successfully relieved the symptoms in most patients. They concluded that the persistent symptoms in 6 patients were the result of residual syndesmotic instability because only the intra-articular pathology was resected and the syndesmosis was not stabilized. Wolf and Amendola stabilized the ankle with a syndesmotic screw when syndesmotic instability remained after arthroscopic debridement of chronic unstable syndesmosis. Using the Edwards and DeLee ankle rating scale, 2 of 14 patients had an excellent result, 10 had a good result, and 2 had a fair result. Some authors have suggested an anatomical reconstruction of the syndesmosis. Beumer et al. described a technique of anteroinferior tibiofibular ligament reconstruction in 9 patients with arthroscopically confirmed instability of the syndesmosis. The tibial insertion of the anteroinferior tibiofibular ligament was mobilized medially and proximally and was then fixed with a screw. A syndesmotic screw was placed for 6 weeks, combined with a cast and nonweight bearing. After a mean 45-month follow-up, all patients improved, and none reported instability.

Grass et al. described a modified Castaing technique in the case of chronic syndesmotic instability after fracture-dislocations of the ankle. With this technique, a ligamentoplasty with the peroneus brevis tendon is performed. In addition to the Castaing technique, which reconstructed the anteroinferior and posteroinferior tibiofibular ligaments, Grass et al. also reconstructed the interosseous ligament. Sixteen patients were reviewed at a mean of 16.4 months postoperatively. All patients were relieved of chronic instability and pain, except 1 patient, who had a persistent dysesthesia related to his initial surgery.

Only 1 report exists of syndesmodesis as a treatment for chronic syndesmotic instability. Katzenelson et al. reported 5 patients treated with rotated bone-plug fusion and a temporary lag screw. One patient suffered from Sudeck’s atrophy up to 6 months postoperatively.

A syndesmotic screw was used in the current patients to stabilize the injured syndesmosis. This approach was chosen because syndesmodeisis is a salvage procedure and because anatomic reconstruction is more complex.

Conclusion

Anteroinferior tibiofibular ligament rupture is an underestimated injury that is commonly more disabling than a lateral ankle sprain. The duration of symptoms is longer and more severe, often leading to chronic symptoms or ankle instability requiring operative stabilization. When pain over the anteroinferior tibiofibular ligament and instability persist after an ankle sprain despite proper conservative treatment, an isolated distal tibiofibular syndesmosis injury should be suspected. Complementary stress test radiographs, MRI, or diagnostic arthroscopy may be performed. A simple stress test radiograph may reveal an unstable grade III syndesmosis sprain that may go unrecognized on plain anteroposterior, mortise, or lateral views of the ankle. After arthroscopic debridement and stabilization of the syndesmosis with a screw, 3 of 4 patients showed good recovery 1 year postoperatively. Because case series remain the highest level of available evidence, more extensive studies comparing the outcomes of different stabilization techniques are necessary to guide treatment.

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