Academy of PHYSICAL MEDICINE

Research Paper Review

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1. Injuries to the ankle syndesmosis. Journal of Bone & Joint Surgery

(Am) 2014; 96:603-13

Van Heest TJ & Lafferty PM

and

2. Evaluation and treatment recommendations for acute injuries to the ankle syndesmosis without associated fracture

Sports Medicine 2014; 44:179–188

Miller TL & Skalak T.

ABSTRACT 1

Despite being common, syndesmotic injuries are challenging to diagnose and treat.

- *Anatomic reduction of the ankle syndesmosis is critical for good clinical outcomes.*
- *Intraoperative three-dimensional radiography and direct syndesmotic visualization can improve rates of anatomic reduction.*
- *The so-called gold-standard syndesmotic screw fixation is being brought increasingly into question as new fixation techniques emerge.*
- *Syndesmotic screw removal remains controversial, but may allow spontaneous correction of malreductions.*

Ankle injuries are commonly seen by orthopaedic surgeons for definitive treatment. Approximately 5% to 10% of all ankle sprains and 23% of all ankle fractures involve trauma to the distal tibiofibular syndesmosis. The coexistence of osseous or deltoid ligament injuries can critically destabilize the ankle.

Despite the common occurrence of ankle injuries, a recent survey of orthopaedic and trauma surgeons found disagreement with regard to the treatment of syndesmotic injuries. The surgeons reported achieving reduction through several different methods, including manual reduction, or use of reduction forceps, lag screws, or Kirschner wires. Similarly, indications for syndesmotic screw removal include limited ankle motion and the risk of screw breakage. Discrepancies also exist with regard to the number of screws used, number of cortices engaged, level of placement of the syndesmotic screws, time to weight-bearing following surgery, type of anesthesia used during removal, and timing of screw removal.

With such variation and disagreement in treatment strategies, orthopaedic surgeons need to understand the

complex nature of the distal tibiofibular joint, pitfalls associated with treatment, and current evidence regarding management of syndesmotic injuries.

ABSTRACT 2

Syndesmosis injuries are rare, but very debilitating and frequently misdiagnosed. The purpose of this clinical commentary is to review the mechanisms of syndesmotic injuries, clinical examination methods, diagnosis, and management of the injuries. Cadaveric studies of the syndesmosis and deltoid ligaments are also reviewed for further understanding of stress transmission and the roles of different structures in stabilizing the distal syndesmosis. External rotation and excessive dorsiflexion of the foot on the leg have been reported as the most common mechanisms of injury. The injury is most often incurred by individuals who participate in skiing, football, soccer, and other sport activities played on turf. The external rotation and squeeze tests are reliable tests to detect this injury. The ability of imaging studies to assist in an accurate diagnosis may depend on the severity of the injury. The results of cadaveric studies indicate the importance of the deltoid ligament in maintaining stability of the distal tibiofibular syndesmosis and the congruency of the ankle mortise. Intervention programs with early rigid immobilization and pain relief strategies, followed by strengthening and balance training are recommended. Heel lift and posterior splint intervention can be used to avoid separation of the distal syndesmosis induced by excessive dorsiflexion of the ankle joint. Application of a rigid external device should be used with caution to prevent medial-lateral compression of the leg superior to the ankle mortise, thereby inducing separation of the distal syndesmosis articulation. Surgical intervention is an option when a complete tear of the syndesmotic ligaments is present or when fractures are observed.

ANALYSIS

Reviewed by Dr. Jeff Muir DC (Research Review Service)

Background Information

Ankle syndesmosis injuries, also referred to as 'high ankle sprains', are particularly common in athletic populations. Affecting the distal tibiofibular joint, the prevalence of this injury is estimated at 15 cases per 100,000 people in the population (1), occurring most often in sports requiring the ankle to be held in a fixed boot, such as skiing or hockey (2, 3). Up to 10% of ankle sprains (4, 5) and 23% of ankle fractures (6) involve trauma to the distal tibiofibular syndesmosis.

Despite the relative frequency of these injuries, disagreement exists amongst practitioners regarding the most appropriate and effective treatments. The potential damage to the lateral ligamentous structures presents special challenges for treatment, making this type of injury more difficult to diagnose and manage effectively (7).

This review examines two recent clinical publications regarding the diagnosis and management of ankle syndesmosis injuries, with special focus on surgical and conservative treatment options and their clinical efficacy.

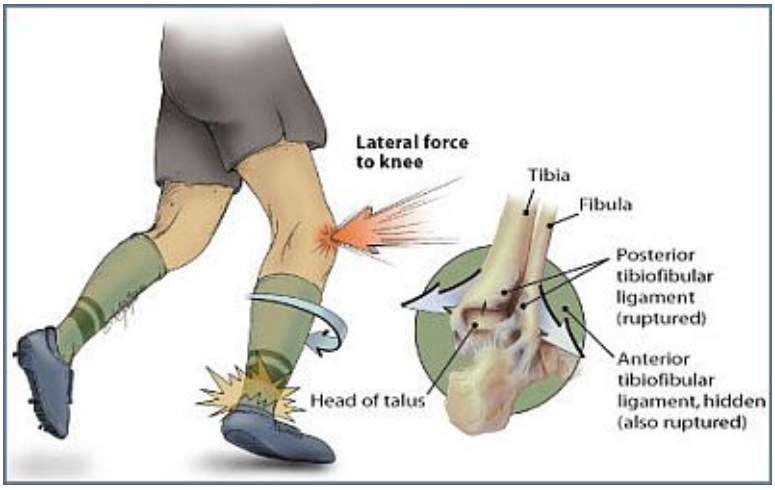
SUMMARY

Anatomy

The bony structures of interest in the ankle mortise include the distal tibiofibular joint and the tibiotalar joint. The distal tibiofibular joint is formed by the convex side of the medial distal fibula (also called the 'incisura fibularis'), and the concave lateral distal tibia. Four distinct ligaments provide support to the distal tibiofibular articulation, creating a relatively stable joint characterized by widening of only 1 mm during normal gait (8). The orientation and location of the anterior and posterior branches of the fibular (peroneal) artery, which supply the tibiofibular ligaments, result in blood supply being at considerable risk of injury in this area.

Mechanism of Injury

Injury to the ankle syndesmosis occurs most often via a combination of external rotation and hyperdorsiflexion, which, in addition to athletic injuries, can occur as a result of low-energy trauma, such as falling on stairs or slipping on ice.



Classification of Injury

Injury classification has generally been based on a three-level grading system, including a simple sprain without diastasis (Grade I), latent diastasis present only on stress radiographs (Grade II) and a frank separation visible on routine films (Grade III). An alternate grading system, based on magnetic resonance imaging (MRI), adds a fourth grade. This system classifies injuries based on ligamentous involvement, ranging from injury to only the anterior ligament (Grade I), through injury to all four ligament (Grade IV).

Diagnosis

Radiographs augment orthopaedic testing in diagnosing syndesmotic injuries. Both gravity/external rotation stress radiographs and traditional radiographs are useful for diagnosis, with stress films valuable for revealing frank diastasis. Orthopaedic testing relies on a number of stress tests (external rotation test, squeeze test, cross-leg test and forced dorsiflexion test – see below) which all challenge the tibiofibular joint and, in cases of syndesmotic injury, result in pain in the injured joint. Conversely, decreased pain with compression is suggestive of a syndesmotic injury.

Clinical Tests – Descriptions

- *External Rotation Test*: knee and ankle are stabilized at 90° flexion and the ankle is externally rotated (positive test = pain over the syndesmosis)
- *Squeeze Test*: the proximal ends of the tibia/fibula are compressed – which should act to put an opening stress on the distal articulation (positive test = pain over the syndesmosis)
- *Cross-Leg Test*: patient sits with both knees in 90° flexion and feet on the ground; the injured leg is lifted and the ankle is placed on the superior aspect of the uninjured knee; gentle downward pressure is applied to the knee of the injured leg (positive test = pain over the syndesmosis)
- *Forced Dorsi-Flexion Test*: ankle is moved into end-range dorsiflexion, then the motion is repeated with compression over this distal tib-fib (positive test = decreased pain over the syndesmosis when compression is added)

Treatment of Syndesmosis Injuries

Non-Operative Treatment

A three-phase treatment plan has been proposed for conservative treatment (9).

1. Phase I focuses on protecting the injury and managing pain and swelling through immobilization, limited weight-bearing, light motion exercises and rest/ice/compression/elevation.
2. Patients then transition to Phase II (strength/proprioceptive/mobility exercises) when pain and edema are well controlled and the patient can walk with minimal antalgic gait.
3. Phase III is generally reserved for patients wishing to return to athletic activities and includes rigorous strengthening exercises and sports-specific rehabilitation.

Operative Treatment

Grade II and III injuries are unstable by nature and often require surgical intervention. Reduction quality has been shown to have a significant impact on long-term prognosis, as mal-reduction is a concern in cases of inadequate angulation of reduction (10).

Rigid fixation via open reduction and internal fixation (ORIF) with 3.5 mm cortical screws is considered the gold-standard for surgical fixation (11). Fixation hardware is typically removed between 12 and 16 weeks postoperatively to prevent breakage. The ideal fixation technique (one vs. two screws and capturing three vs. four cortices) remains under debate, as no study has shown biomechanical superiority.

Suture button fixation gained popularity in the 1990s and consists of passing a guide pin across both the distal tibiofibular joint approximately 1 cm proximal to the tibial plafond. The suture button is then passed through the guide pin tunnel. The non-absorbable suture ends are toggled to tighten the locking sutures and secure the fibula into its anatomic position. This technique does not require a second procedure to remove hardware, and has been shown to provide an improved anatomic reduction (12).

Posterior malleolar fixation, in cases of an intact posterior inferior tibiofibular ligament, also adequately

stabilizes the syndesmosis (13). The posterior malleolus can be fixed utilizing percutaneous anterior-to-posterior screws when the fragment is minimally displaced.

Potential Surgical Complications

Mal-reduction of the syndesmosis is the most significant complication and is of long-term concern, as it can lead to poor functional outcomes and post-traumatic osteoarthritis (14). In fact, anatomic reduction is of greater concern than over-compression during screw fixation (15).

Hardware failure and screw removal are concerns, as fixation limits fibular mechanics. As weight-bearing increases, the shear forces involved can result in screw breakage. Screw breakage has been reported to occur in 7% to 29% of patients who have had fixation, depending on the time of screw removal (16).

Obese patients, or those with neuropathic conditions such as diabetes mellitus, are at risk for implant complication. Patients with complicated diabetes are 3.4 times more likely to have malunion, nonunion, or Charcot arthropathy and five times more likely to need revision surgery following ankle fractures compared with patients with uncomplicated diabetes (17).

Heterotrophic ossification has been reported in between 1.7% to 18.2% of ankle fractures and, in athletic populations, has been reported as high as 50% in patients with syndesmotic sprains (18). This is a factor worth monitoring, particularly in higher-level athletes.

CLINICAL APPLICATION & CONCLUSIONS

Injuries of the ankle syndesmosis ligaments have been strongly linked with a prolonged recovery and increased time to return to play – these are not regular ankle sprains and require a specialized level of careful assessment and management. As mentioned earlier, sports requiring the ankle to be in a fixed boot are at higher risk of this type of injury. While conservative care is adequate for many patients, a significant portion require surgical intervention, although a definitive treatment option has yet to be identified. Regardless of the type of treatment, recovery from this injury can be slow (something that should be effectively communicated with the patient to manage their recovery expectations). In addition to a thorough history and physical examination, appropriate imaging is necessary to effectively diagnose and classify this injury.

STUDY STRENGTHS / WEAKNESSES

The authors of both reviews compiled a comprehensive review of the current knowledge regarding mechanism of injury, diagnosis and treatment of ankle syndesmotic injuries. While the background information is broad, the treatment focus falls largely on the surgical options, which may be expected, given that the authors themselves are surgeons. This provides a moderate limitation for those non-surgical practitioners, although the information provided is generally of good clinical value and should help to augment the treatment plans of all clinicians.

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