From Low to High – Management of Ankle Instability in Lacrosse Players
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ABSTRACT

Acute ankle sprains are one of the most common lower extremity injuries sustained by athletes and it is particularly common in sports such as lacrosse. The majority of ankle sprains affect the lateral ligaments; however, injuries can also occur to the medial ankle and the syndesmosis ligaments, commonly referred to as high ankle sprains. Despite its high prevalence, a significant proportion of athletes experience residual symptoms and recurrence of injury, prolonging their ability to safely return to sport. Depending on the severity of injury, management often includes rehabilitation with conservative modalities, such as RICE therapy, and adjunctive treatments like bracing, immobilization, and foot orthotics. Severe or refractory cases may warrant operative intervention. There remains significant emphasis on the importance of the rehabilitation process, regardless of whether conservative or surgical management is pursued. The purpose of this review is to provide an overview of the management of ankle injuries in lacrosse players.
INTRODUCTION

Lacrosse is one of the most popular and fastest growing team sports in the United States at both the high school and collegiate levels[1]. It is a unique team sport with physiological demands including speed, endurance, strength, and agility. Lacrosse has a unique injury profile given the prevalence of multidirectional cutting, dodging, and torsion movements as well as collision activity involved in playing the sport[2]. The most common injuries at the collegiate levels for both male and female lacrosse players are ankle sprains, ligamentous knee injuries, and concussions [3, 4]. The NCAA surveillance system found that ankle ligament sprains comprise 14.4% of the total injuries reported for men’s lacrosse and 15-25.1% of total injuries in women’s lacrosse players [5]. During the 2018 Men’s World Lacrosse Championship, injuries to the lower extremities accounted for nearly half (47%) of all the injuries with most lower extremity injuries occurring from a noncontact mechanism involving cutting and dodging movements [2]. Athletes are four times more likely to sustain an injury during a game versus practice, with the most common lower extremity injury being ankle ligament sprains[4, 6].

Acute ankle injuries in athletes can cover a broad spectrum of injury. The ankle joint and the surrounding structures form a complex structure that synchronously helps stabilize the hindfoot and guide passive joint motion. Numerous ligaments play a critical role in stabilizing the ankle joint, which are distributed in the lateral, medial, or syndesmotic areas. These are classically organized into three major categories of ankle injuries: low (lateral), high (syndesmotic), or medial injuries.

Low ankle injuries refer to injury to the lateral ligaments of the ankle, which most commonly involves the anterior talofibular ligament (ATFL), the calcaneofibular ligament (CFL), and less commonly the posterior talofibular ligament (PTFL) (Figure 1). Almost 85% of
ankle sprains involve the lateral ligaments with about 65% being an isolated injury to the ATFL. The remaining 15% of ankle injuries involve the medial ankle or syndesmotic injuries, which refer to an injury to one or more of the ligaments comprising the distal tibiofibular junction, often referred to as a “high ankle sprain” [7].

Figure 1: Lateral ligaments of the ankle. Reprinted with permission of the Radiological Society of North America from Muhle. The Creative Commons license does not apply to this content. Use of the material in any format is prohibited without written permission from the publisher.

Syndesmotic stability is conferred by both the osseous and ligamentous relationships between the distal tibia and fibula. The anterior inferior tibiofibular ligament (AITFL), interosseous ligament (IOL), interosseous membrane (IOM), posterior-inferior tibiofibular ligament (PITFL), and inferior transverse (tibiofibular) ligament (ITL) compose the syndesmosis (Figure 2) [8]. The syndesmosis is an inherently stable articulation that allows motion in the coronal, sagittal, and transverse planes.
The deltoid ligament spreads in a fan shaped manner over the medial aspect of the ankle joint and is an important structure in maintaining stability against valgus and rotatory forces. There are six distinct components of the deltoid ligament. The 4 superficial ligaments consist of the tibiospring ligament (TSL), tibionavicular ligament (TNL), superficial posterior tibiotalar ligament (STTL) and tibiocalcaneal ligament (TCL), which crosses the ankle and subtalar joint. The deep components consist of the deep posterior tibiotalar ligament (PTTL) and anterior tibiotalar ligament (ATTL), which only cross the ankle joint (Figure 3). The superficial ligaments limit talar abduction, while the deep layers limit external rotation. Both play an integral role in limiting talus pronation [9].
While ankle injuries are one of the most common injuries sustained by athletes, it is the high recurrence rate, with 80% suffering recurrent ankle sprains and 72% developing recurrent symptoms or chronic instability [10], which deems thorough evaluation and proper management critical to recovery. This review will focus on the management considerations in the different types of ankle injuries in high level athletes, with a particular focus on lacrosse players.

LOW ANKLE SPRAINS

Low ankle sprains (LAS) are injuries to the lateral ligaments of the ankle. Almost 85% of ankle sprains involve the lateral ligaments [7]. The high incidence of this subset of ankle injury can partly be explained by the natural tendency of the ankle joint to go into inversion with dodging or cutting and weakness of the lateral ligaments, in particular the anterior talofibular ligament (ATFL). In 65% of cases, there is an isolated injury of the ATFL and 20% of cases involve injury to both ATFL and calcaneofibular ligament (CFL) [11]. Re-injury rates after a
lateral ankle sprain is noteworthy, with a systematic review noting a recurrent injury rate between 3-34% and studies citing 40% of individuals developing chronic ankle instability after a first-time sprain [11]. Classically, the athlete will often report an inversion type injury, which consists of supination (plantarflexion, inversion, and internal rotation of foot) coupled with external rotation of the lower leg. The ATFL, which is the weakest of the lateral ligaments, is often the first ligament to be injured, followed by the CFL, and then the PTFL. The PTFL is not commonly injured due to the substantial supination force required by the foot in an inversion sprain, or the degree of ankle dorsiflexion needed to strain or tear that ligament.

**CLINICAL EVALUATION**

Provocative tests such as the anterior drawer and talar tilt (inversion stress) tests are useful to evaluate lateral ankle instability. The anterior drawer and talar tilt test are specific for assessing the integrity of the ATFL and the CFL[12, 13]. These provocative maneuvers are more appropriate when performed 5-7 days after injury following improvement of initial pain and swelling [14, 15]. Grading of ankle sprains depends on the integrity of the ligaments (Table 1). In terms of low ankle sprains, it depends on the disruption of the ATFL. A grade I injury represents an intact ligament however perhaps with some degree of microscopic injury. A grade II injury is a stretch to the ligament without a tear. A grade III injury is a complete rupture of the ligament [16].

**Table 1: Grading ankle injuries**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Ligament Integrity</th>
<th>Ecchymosis/Swelling</th>
<th>Pain with Weight Bearing</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Intact</td>
<td>Minimal</td>
<td>Normal</td>
</tr>
<tr>
<td>II</td>
<td>Stretch or Partial tear</td>
<td>Moderate</td>
<td>Mild</td>
</tr>
<tr>
<td>----------</td>
<td>-------------------------</td>
<td>----------</td>
<td>------</td>
</tr>
<tr>
<td>III</td>
<td>Complete tear</td>
<td>Severe</td>
<td>Severe</td>
</tr>
</tbody>
</table>

**MANAGEMENT**

There currently exists a broad spectrum of treatment modalities in acute LAS. These range from the classically described rest, ice, compression, and elevation (RICE) modality to surgical intervention. Conservative modalities include RICE therapy, immobilization, nonsteroidal anti-inflammatory drugs (NSAIDs), functional rehabilitation (including proprioception training) and exercise as well as other adjuncts [14]. Treatment should be tailored based on the patient’s time from injury and stage of healing [17].

In the initial stages of injury, conservative management such as RICE therapy, immobilization and NSAIDs are encouraged. Review of the components of RICE therapy have been mixed when evaluated in isolation [7, 18, 19]. Despite the lack of academic consensus, the RICE method continues to be a mainstay of therapy during the acute, inflammatory stage [17]. Immobilization is encouraged briefly after injury. However, the degree of immobilization varies, with semi-rigid ankle braces in Grade I and II injuries and below knee casting preceding ankle bracing in grade III injuries [20, 21]. Consensus is that immobilization should be limited to a short period of no more than 7-10 days, NSAIDs are a reasonable adjunct to initial conservative management. They are effective for alleviating pain, fever, and inflammation by blocking the synthesis of prostaglandins (PGs) through inhibition of cyclooxygenase (COX) enzymes. While a potent pain reliever, prolonged use of a high dose of NSAIDs can cause a myriad of side effects (ex. gastrointestinal ulcers, asthma exacerbation, cardiovascular events, hypertension, acute renal failure etc.) due to the role of PG in a variety of cellular processes. Thus, NSAIDs
should be used with caution with the lowest effective dose and shortest possible time prescribed[22].

Physical therapy is a treatment adjunct that can be utilized in both conservative and operative management. Physical therapy should include functional rehabilitation focused on balance and proprioception has been found to be particularly beneficial for ankle instability and assist with return to lacrosse activities. In a randomized, controlled trial of 503 participants with Grade I and II ankle sprains, Brison et al. found a trend toward clinical benefit with physiotherapy, but these trends did not achieve statistical significance [23]. This differs from a recent scoping review of 37 articles demonstrating that, in athletic populations, early dynamic training resulted in improved performance, return to play and re-injury [24]. It is conceivable that physical and functional rehabilitation would be more feasible in a closely followed athletic population. The use of an ankle support orthosis along with taping can be beneficial while returning to drills and game play.

FUNCTIONAL REHABILITATION

The role of rehabilitation in the management of acute ankle injuries should not be underestimated, particularly given the high incidence of refractory symptoms and injury recurrence particularly in athletes playing sports like lacrosse that require changing direction and dodging. In athletics, the ability to control one’s balance or proprioception becomes critical in avoiding injury. Proprioception is defined as the neural process in which the body takes in sensory input from the environment and integrates that information to guide a motor response [25]. Ankle proprioception may be altered in the setting of injury due to weakening of the ankle joint’s passive (joint capsule) and dynamic (muscle) stabilizers leaving it prone to reinjury [26].
Incorporating proprioceptive training into rehabilitation after an ankle injury has been strongly advocated as improving balance control has been strongly positively associated with enhanced athletic performance and negatively associated with lower extremity sports injuries [25]. Examples of proprioception training for the ankle joint include balancing on a single leg with eyes closed, balancing on a wobble board or ankle disk, and balancing on a single leg while performing tasks like catching or throwing a ball [27]. The purpose of these exercises is to strengthen the athlete’s ability to adapt to the changing environment and subsequently protect themselves from injury. Proprioceptive training may also help reduce the athlete’s subjective instability and consequently improve functional outcomes. In a systematic review, Rivera et al. found that proprioceptive training programs were effective in reducing the incidence rates of ankle sprains in those with and without a history of ankle sprains [27]. Thus, proprioceptive rehabilitation is an effective intervention both time and cost-wise in helping an athlete not only reduce their risk of further complications following an ankle sprain but to potentially help avoid an initial injury and should be integrated into the training and rehabilitation program of all athletes.

SURGICAL INDICATIONS AND MANAGEMENT

In a recently updated clinical practice guideline, Vuurberg et al. propose that surgical intervention is generally indicated in three populations: those that fail conservative management, those that have chronic instability, and/or those that are professional athletes [19]. These guidelines are commonly accepted in past literature and result in the largely nonoperative management of first time LAS [28]. Upon meeting the aforementioned operative thresholds,
surgical repair ranges from anatomic repair with possible augmentation, possible arthroscopy, and non-anatomic reconstruction with tenodesis [29].

There are numerous nuances to the manner in which the ATFL and CFL are repaired or reconstructed. An initial surgical consideration includes the viability and amount of ATFL and CFL remaining for the repair. The major form of repair in a primary case is the Brostrom. This involves a direct repair of the remnant ATFL and CFL to their attachments to the fibula. There are various modifications. The Gould modification is the most common and incorporates the inferior extensor retinaculum into the repair (Figure 4). To repair the ligaments, suture anchors or bone tunnels can be utilized. Hu et al. found no statistically significant differences in PROM, talar tilt, and anterior talar translation between suture anchors or bone tunnels [30]. There remains controversy of whether to utilize a synthetic augmentation (internal brace; Arthrex Inc, Naples FL) with primary repairs. Biomechanical data demonstrates that constructs with synthetic augmentation are stronger, however long-term clinical data remains limited. Advocates for augmentation suggest possible earlier return to play.

Low ankle sprains can be managed both open and arthroscopically. Ankle arthroscopy is increasingly performed when managing acute and chronic ankle injuries in the athlete. The degree and pattern of ankle instability on both the medial and lateral sides can be assessed. Associated injuries, such as cartilage lesions, can also be diagnosed and concomitant procedures such as removal of loose bodies, debridement, or microfracture can be performed (Figure 5). Surgical options for concomitant deltoid repair mainly consist of osseous sutures or suture anchors though no studies have evaluated the two procedures alone [31, 32].

When comparing arthroscopic or open surgical treatment of the lateral ligaments, Zeng et al. found similar AOFAS and Karlsson scores between patients managed with arthroscopic and
open ATFL repair at the 3-year mark. However, they identified that the patients undergoing arthroscopic repair had higher surgical cost and longer operative time [33]. Arroyo-Hernandez et al. demonstrated a complication rate of 14% with a 100% return to play rate at an average of 21.5 weeks after arthroscopic ATFL repair though they did not have a matched direct-repair cohort [9]. Though there are slight differences in outcomes reported in the literature, the arthroscopic approach to low ankle sprain repair shows promise and requires more research. The lead author believes that this is a worthwhile surgical option that is likely to be more advantageous in the hands of a surgeon with a high degree of experience in ankle arthroscopy.
Figure 4: Intraoperative images of ATFL repair using Gould modification at author’s home institution. A) Image demonstrating the remnant ATFL and inferior retinaculum as two separate layers; B) Image of placement of suture anchors; C) Image of suture being passed to incorporate the remnant tissue and the inferior retinaculum.

Figure 5: A) Intraoperative photos at author’s home institution showing arthroscopic set up B) traction placed to improve visualization C) and Arthroscopic evaluation of ankle instability allows for evaluation of distal tibia and talar dome chondral lesions

MEDIAL ANKLE SPRAINS

Deltoid ligament injury most often occurs in a pronation-eversion mechanism at the ankle joint in contrast to supination-inversion injuries with more common sprains. Patients with pre-
existing injuries and increased pronation foot deformity are at an increased risk of injury. Injury to the deltoid ligament can also occur with supination-external rotation movements.

CLINICAL EVALUATION

Athletes will often describe an eversion-pronation event leading to an acute injury. Pain is described in the anteromedial aspect of the ankle with tenderness along the deltoid ligament. In athletes with chronic injuries, diagnosis may be more difficult. Careful attention to the athlete’s history and physical exam is critical. They may report medial or anteromedial instability, particularly with descending stairs or hills. Pain with palpation of the medial gutter of the ankle joint is often a hallmark sign. Varus-valgus stress testing and the anterior drawer test can show laxity about the medial ankle. On exam, the athlete may have more pronounced hindfoot valgus and pronation of the affected foot when compared to the contralateral foot [34]. The examiner should be mindful of other concomitant injuries that are often associated with medial ligament injuries, which include tibial tendon dysfunction, fibular fractures, syndesmotic disruption, rotational instability with insufficiency of lateral ligaments, and spring ligament injuries.

Injuries to the deltoid ligament complex are categorized as superficial or deep, but the grading of injury follows the grading of low ankle sprains with Grade I being a mild sprain/stretch to the ligament; Grade II involving a partial tear; and a Grade III involving a complete tear of the ligament.

MANAGEMENT
Conservative management of deltoid ligament injuries follows a similar trajectory to initial management of low ankle sprains. Initial management often involves immobilization and protected weight bearing. During this time, reducing swelling and managing pain are often the primary concerns. During this period of immobilization, patients can work on controlled open-chain range of motion focusing on dorsiflexion and plantarflexion. Inversion and eversion should be limited. Once weight bearing is tolerated, physical therapy involving muscular strengthening, proprioceptive training, and orthotics with medial support, bracing, or taping can slowly be introduced. Gait training may be needed to ensure the patient is not compensating, which can cause secondary injury. At this point, rehabilitation can follow a similar course as outlined in the functional rehabilitation section for low ankle sprains [35]. If conservative methods fail, surgical treatment may be necessary.

There are a variety of methods of repairing the deltoid ligament. This can be partially attributed to the inherent differences within the ligament itself with both superficial and deep components. Superficial injuries are more common than deep injuries. However, the majority of medial ankle ligament repair literature exists in the setting of ankle fracture or other concomitant soft tissue injury. Lee et al. describe a variety of techniques to address common pathology, including avulsion of deltoid ligament from the medial malleolus. Their methods to address this pathology include medial malleolus preparation, suture anchor placement, and final fixation with a “vest over pants” technique. Superficial deltoid injuries can generally be addressed with either direct repair or a suture anchor [36]. Bone tunnels can also be utilized to secure repairs.

Completely repairing the deltoid ligament may warrant direct repair superficially and augmentation within the deep deltoid ligament. In a 2019 article on combined syndesmotic and deltoid repair, Hajewski et al. presented a combination of superficial deltoid repair with suture
anchors and augmented deep deltoid reconstruction using flexible FiberTape suture [37]. In more chronic cases of deltoid instability where native, normal tissue is minimal, reconstruction with autograft or allograft and bone tunnels has been shown to have therapeutic benefit [38].

**HIGH ANKLE SPRAINS**

Injuries to the distal tibiofibular syndesmosis are often referred to as ‘high ankle sprains’ and comprise up to 12% of all ankle sprains [39]. Most syndesmotic injuries occur during contact with another player and compared with inversion or lateral ankle sprains, are more likely to create long-term dysfunction and require significantly more time for recovery and return to sport [40, 41]. Classic high ankle sprains occur when the foot encounters external rotation force while in a dorsiflexed position. This causes the talus to force the fibula to separate from the tibia, rotate externally, and displace posteriorly [42]. Although external rotation is the most common mechanism associated with high ankle sprains, combined syndesmotic and lateral ankle sprains do occur. In a study of de Cesar et al, they found that 17.8% of patients with lateral ankle sprains also had a concomitant syndesmotic injury, which emphasizes the need for a careful exam regardless of the reported mechanism of injury [31]. It is also important to recognize and to educate the athlete and team that injury to the syndesmosis generally increases recovery time two to three-fold over that of an isolated low ankle sprain [16].

**CLINICAL EVALUATION**

Athletes will often complain of diffuse pain but may localize to the anterolateral or posteromedial ankle joint. The distance that tenderness extends proximal to the ankle joint has
been coined “tenderness length” and this has been correlated to the time to return to sport (RTS).

A longer length correlates with longer RTS. Provocative tests can be helpful in the diagnosis of a high ankle sprain. These tests include the squeeze test, crossed-leg test, external rotation stress test, heel thump test, and Cotton test, which all stress the syndesmosis and elicit pain above the ankle joint (Table 2). The “stabilization test” described by Amendola et al. is performed by tightly taping the patient’s leg just above the ankle joint in order to stabilize the syndesmosis (Figure 6). Patient is asked to perform toe raises, walking, and/or jumping prior to taping and then after taping. If symptoms resolve or improved with taping, this indicates a positive test [43].

In a recent meta-analysis, the dorsiflexion external rotation test was also found to have high intra and inter-rater reliability; however, no single test had high diagnostic accuracy [32].

Table 2: Clinical Tests for High Ankle Sprains

<table>
<thead>
<tr>
<th>Clinical Exam Maneuver</th>
<th>Description</th>
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<tbody>
<tr>
<td>Squeeze Test</td>
<td>Examiner squeezes mid-calf over tibia and fibula to see if this elicits pain distally, suggestive of syndesmosis injury.</td>
</tr>
<tr>
<td>Crossed-Leg Test</td>
<td>Patient sits in a chair with affected leg crossed over contralateral knee. Pressure is applied to proximal fibula of affected leg. Pain at distal ankle suggestive of syndesmosis injury.</td>
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<tr>
<td>External Rotation Stress Test</td>
<td>Patient seated with hips/knees flexed to 90 degrees. Examiner uses one hand to stabilize lower leg while the other hand is used to externally rotate the foot. If this elicits pain, a syndesmosis injury is suspected.</td>
</tr>
<tr>
<td>Heel Thump Test</td>
<td>Patient sits at the edge of exam table with legs hanging down and feet in equinus position. Examiner holds patient’s lower leg with one hand, and using other hand, delivers gentle thump to heel with a fist. This forces the talus to contact the mortise to reproduce pain, which is elicited, is suggestive of a syndesmosis injury.</td>
</tr>
<tr>
<td>Cotton Test</td>
<td>Examiner steadies the patient’s distal leg with one hand while grasping plantar heel with opposite hand and moving heel directly from side to side. Lateral translation would indicate syndesmotic instability.</td>
</tr>
<tr>
<td>Stabilization Test</td>
<td>Patient is asked to perform toe raises, walking, jumping. Patient’s injured leg is then tightly taped just above the ankle.</td>
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and they are asked to repeat these exercises. If symptoms resolve or improve with taping, this suggests syndesmosis injury.

**Figure 6: Syndesmosis “Stabilization Test”**

Injuries involve either a partial or complete rupture of the syndesmosis ligament complex, which can cause diastasis of the inferior tibiofibular joint [16]. Grading of high ankle sprains follow the same grading as low ankle sprains, with Grade I being the mildest form with ligaments being intact. Grade II sprain is partial tear to ligaments and Grade III being a complete tear of the ligaments.

**MANAGEMENT**

Athletes without frank diastases or dynamic instability on weight bearing or stress radiographs can often be managed conservatively. It should be discussed with the athlete that recovery from a syndesmotic injury takes longer compared to other ankle sprains. Nussbaum et al. found that the time to return to full competition was directly associated with the level of
tenderness along the interosseous membrane [39]. Grade III injuries are typically managed with surgical intervention, focusing on anatomic reduction and stabilization of the syndesmosis.

Purely ligamentous injuries with a stable syndesmotic joint can be treated non-operatively with immobilization in a CAM boot. The goals of rehabilitation are early mobility and safe and successful return to play. Functional rehabilitation with proprioception and balance is also useful as with low-ankle sprains. Nussbaum et al. outlined the phases of rehab as acute, focusing on non-weight bearing and reducing inflammation; subacute, focusing on avoiding stiffness with passive ROM exercises and protected weight bearing; and finally, the integration phase, which focuses on strengthening and getting back to sport-specific movements [8]. Unstable syndesmotic injuries in elite athletes or patients with a failure of conservative management are treated surgically with the goal of reducing the syndesmotic joint. Injuries associated with medial, lateral, or posterior malleoli fractures require anatomic reduction which usually reduces the syndesmosis. Upon fracture fixation, syndesmosis stability should be evaluated under arthroscopy or fluoroscopy to assess for either adequate reduction or widening of syndesmosis or medial clear space [41].

Syndesmotic screw fixation is commonly used to repair unstable high ankle sprains with positive outcomes. This method utilizes screws proximal to the syndesmosis placed parallel to the joint across the fibula and tibia. The overall preference post-operatively is non-weight bearing for 4-6 weeks and screws are commonly removed in athletes after a minimum of 8 weeks. There is no consensus on number of screws or number of cortices that are required.

Suture button repair, flexible fixation, is increasing in popularity and utilizes a tensioned suture loop secured on outer cortices of the tibia and fibula with metal buttons (Figure 7). This construct also avoids the need for subsequent hardware removal. Additionally, flexible fixation
has been shown to allow for more physiologic motion as compared to screw fixation however may not be as strong in maintaining reduction of screw fixation [40]. Advantages of the suture button fixation has been shown to include earlier return to work and lower rate of implant removal [42]. The number of suture buttons required has been studied in controlled biomechanical studies which demonstrate that one or two, as well as parallel or divergent buttons have similar strength. An additional benefit of suture button fixation is that traditional use of large periarticular clamps to hold reduction during screw placement can be avoided, as studies have found this technique can increased risk of malreduction. While tightening suture buttons, the syndesmosis can be manually reduced and allow the fibula to find its natural position within the incisura. There is increasing interests in direct repair or reconstruction of the anterior-inferior tibiofibular ligament with promising early data, but more clinical data is required [44].

Post-operative rehabilitation plays an important role to regain function and promote natural healing of the syndesmosis ligaments [45]. Protected weight-bearing and RICE therapy are implemented immediately and are transitioned to passive ROM exercises in the opposite direction of the mechanism of injury in the first week after surgery. Proprioception and sport-specific movements allow for muscle strengthening around the ankle and allows the patient to evaluate performance throughout the rehab process. Return to sport may be considered 3-6 months following surgery.
Figure 7: A) arthroscopic picture of the “drive through” with a 3.5mm shaver going into the syndesmosis seen with syndesmotic injury; B) Post op radiograph of syndesmotic suture button fixation placed in divergent pattern.
CONCLUSION

Given the high incidence of ankle instability injuries in the lacrosse athlete, as well as the significant proportion of residual symptoms, it is important to understand the mechanism and rehabilitation protocol for ankle instability injuries. Lateral ligament injuries, low ankle sprains, are the most common form of ankle instability injury and are best treated conservatively initially with functional rehabilitation with proprioception training. Operative intervention may be warranted for the following groups with lateral ligamentous injury: those that fail conservative management, those that have chronic instability, and/or those that are professional athletes. Medial ankle instability injuries, most importantly rupture of the deltoid ligament, are often treated in relation to the grade of injury with conservative management pursued prior to operative intervention. High ankle sprains, injuries to the syndesmosis, tend to occur with a different mechanism of injury external rotation and pronation but can occur concomitantly with low ankle sprains. Initial treatment typically also includes functional rehabilitation with proprioception training. It is important to advise athletes that recovery is longer than standard low ankle sprains. Operative treatment can be considered in refractory cases or acutely in elite lacrosse players. Syndesmotic injuries are commonly associated with fractures, specifically of the posterior malleolus, and those injuries commonly undergo operative intervention with anatomic reduction of the fracture and the syndesmosis.

The decision to return to sport can be challenging and should involve a multidisciplinary approach, with the knowledge that there is a high rate of residual symptoms and injury recurrence. Knowledge of ankle instability injuries, treatment, and rehabilitation is important for understanding the lacrosse player and how to prevent future injuries.
REFERENCES


