Iliotibial Band Rupture Associated With an Acute Knee Dislocation in a Collegiate Football Player

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ABSTRACT
A collegiate football player sustained a traumatic hyperextension knee injury during a game. The initial diagnosis was a self-reducing knee dislocation with multiple-ligament ruptures. Magnetic resonance imaging revealed associated iliotibial band (ITB) rupture. This case demonstrates the treatment and care of this unique injury. Sports medicine practitioners should note the importance of the ITB as it relates to knee stability.

Knee dislocations are an uncommon occurrence in sports. According to McKee et al.,1 traumatic knee dislocations are a serious and potentially limb-threatening injury, with a reported incidence of approximately 0.02% to 0.2% of orthopedic injuries. Knee dislocations occur in younger patients with a male-to-female ratio of 4 to 1.2 They primarily result from motor vehicle accidents (50%), sports injuries (one-third), and simple falls (10%).3 A knee dislocation often results from injury to two or more of the main ligament structures (anterior or posterior cruciate ligaments, lateral ligament complex, or medial collateral ligament) along with the risk of periarticular fracture and neurovascular damage.3 The specific combination of injury to the anterior and posterior cruciate ligaments, lateral collateral ligament, and posterolateral corner is the more typical of injury configurations.4

The iliotibial band (ITB) is a component of the lateral soft tissue structures and contributes to the lateral stability about the knee joint. Injuries solely to the lateral side of the knee are rare and account for 1% of all knee injuries.5 When injuries to the lateral side of the knee occur, they are often part of multiple-ligament knee injuries or knee dislocations.5 Common isolated ITB injuries are typical of a chronic tendinopathy such as ITB friction syndrome and snapping hip syndrome. There is little information regarding injury of the ITB in acute knee trauma as a discrete structure.6

According to a study by Mansour et al.,6 the ITB was found to have a grade 3 tear in only 2.5% of the cases in a series of 200 knee trauma magnetic resonance imaging (MRI) scans reviewed. Of the 5 cases in which ITB ruptures were found, injuries to both the anterior and posterior cruciate ligaments, both the medial and lateral collateral ligaments, and the posterior lateral corner were also found. The ITB aids in stabilizing the anterolateral knee and resists varus stress and rotation. Compared to the menisci, cruciate, and collateral ligaments, the ITB is infrequently mentioned in the context of acute knee trauma.6 Nevertheless, an ITB avulsion fracture from its attachment to Gerdy’s tubercle is occasionally seen in conjunction with lateral ligament injuries.6 Clinical studies have indicated a synergistic interaction between ITB disruption and anterior cruciate ligament tears in anterolateral rotary instability.7 It is thought that the capsulo-osseus layer of the iliotibial tract provides a fascial sling behind the lateral femoral condyle and that this functions as a restraint to help the anterior cruciate ligament prevent abnormal anterior translation of the tibia.7 Because the ITB functions to help stabilize the anterolateral aspect of the knee, it is reasonable to presume that with a knee dislocation involving the anterior cruciate and lateral collat-
eral ligaments and posterior lateral corner sustaining significant trauma, the ITB would also be injured secondarily.

The superficial layer of the soft tissue of the lateral knee includes the ITB and tendon of the biceps femoris. The ITB is a distal continuation of the deep fascia of the thigh (fascia lata) receiving insertions from the gluteus maximus and tensor fascia lata muscles.6 The ITB passes over the anterolateral aspect of the thigh, crosses the lateral femoral condyle, and inserts into Gerdy’s tubercle at the anterolateral aspect of the proximal tibia (Figure 1).6 Because of the location of the ITB to the anterolateral aspect of the knee, one must be wary of injury to the ITB when there is significant trauma to the posterolateral corner and anterior cruciate ligament. The anatomy of the posterolateral corner is a complex collection of multiple structures, including the lateral collateral ligament, ITB, popliteus tendon, popliteofibular ligament, arcuate ligament, mid-third lateral capsular ligament, posterolateral joint capsule, and fabellofibular ligament.4 No single element of the posterolateral corner functions in isolation and all components resist varus rotation, external tibial rotation, and posterior translation to some degree.4 There is an increasing awareness to recognize injury to the posterolateral corner in acute knee trauma. However, little is documented on abnormalities of the ITB as a distinct entity in knee trauma.6

Reports of ITB rupture or avulsion in knee dislocations are extremely rare. The reported cases of ITB rupture are not isolated events, but appear to occur in combination with injuries to the posterolateral structures of the knee. There is a reported case of an ITB rupture after a corticosteroid injection in a 27-year-old U.S. Navy Special Warfare Candidate student with no significant medical or surgical history.8 As discussed earlier, Mansour et al.6 reported 5 cases of ITB rupture following serious knee trauma. The literature has contradictory studies showing a lack of ITB involvement with traumatic multiple-ligament knee injury events. Tzurbakis et al.9 did not recognize or note any ITB disruption in their 44-patient case study involving surgical repair of multiple-ligament injuries. In another study involving 17 cases of knee dislocations treated in a 5-year period, the ITB was not found to be torn or involved in the associated patients.10 Additionally, Twaddle et al.3,11 5-year study on 63 cases requiring surgical repair as a result of a knee dislocation injury did not identify the ITB as an injured structure. These opposing studies chose to acknowledge injury primarily to the cruciates, menisci, and collateral ligaments because they are commonly traumatized with a diagnosed knee dislocation.

Because the ITB is not routinely documented as being linked with multiple-ligament knee injuries, sustaining a partial or complete rupture of the ITB seems unique. This article describes the case of a collegiate football player who sustained a multiple-ligament knee injury while participating in a collegiate football game and was discovered to have an unsuspected ITB rupture only at the time of the MRI.

CASE REVIEW

An 18-year-old male football player was struck to the right knee during a kick-off return play in a collegiate football game. End-zone view photographs of the event showed that the knee and tibia sustained a direct blow, thus forcing the involved knee to hyperextend and sustain extreme varus stress (Figure 2). On completion of the play, the athletic training staff attended to the athlete on the field. Initial evaluation was gross multiple-ligament instability to the anterior cruciate, medial, and lateral collateral ligament structures. Further evaluation on the sideline by the team physician also included significant laxity to the posterior cruciate ligament, but no neurovascular compromise was noted. The initial sideline diagnosis was an acute self-reducing knee dislocation.

Complete tearing of the medial collateral ligament is found with marked joint line opening and strongly suggests that the anterior and posterior cruciate ligaments may be ruptured.12 For anterior cruciate ligament rup-
tures, the Lachman, Pivot Shift, and Varus Stress tests are found to have a high specificity; the Lachman test also has high sensitivity.\(^\text{12}\) As discussed earlier, knee dislocations are defined as having ruptures of two or more stabilizing ligaments of the knee. As such, evidence-based medicine concurs with our case study diagnosis of an apparent knee dislocation.

The athlete was treated with ice packs, placed in a knee immobilizer, and given crutches to use for ambulation. He was later evaluated by the team orthopedic physician, who confirmed the original findings of a multiple-ligament injury of the knee that was thought to be a spontaneous reduced knee dislocation. Radiographs were taken and showed no bony fractures. MRI findings showed complete rupture of the anterior and posterior cruciate ligaments, lateral collateral ligament, and posterior lateral corner. There was partial tearing of both heads of the gastrocnemius tendons, the vastus medialis and lateralis at their insertions, and the biceps femoris and semimembranosus. There was a large tear noted to the medial meniscus. The athlete also had complete disruption of the ITB with 9 mm of retraction (Figure 3). An immediate surgical intervention to stabilize the knee was recommended and the athlete opted to pursue the surgical repair through a different orthopedic group.

Thirteen days post-trauma, the athlete had a surgical procedure performed to initially stabilize the posterolateral corner of the knee. The lateral capsule, lateral collateral ligament, and biceps femoris were repaired with sutures. The partial tear to the medial meniscus was addressed and the ITB was reattached to the tibia at Gerdy’s tubercle. Surprisingly, the posterior cruciate ligament was found to be intact under direct examination, but the anterior cruciate ligament was ruptured as initially suspected. Reconstruction of the anterior cruciate ligament was deferred at this time by the attending surgeon. The patient was placed in a knee immobilizer and was non-weight bearing using crutches for the next 2 weeks.

The student-athlete’s post-trauma protocol is outlined in Table 1. He was treated with cryotherapy and electrical muscle stimulation to decrease swelling and limit atrophy. As his pain and postoperative edema decreased, he began isometric straight-leg raises and ankle pumps. At 2 weeks postoperatively, he was permitted to begin passive assisted range of motion (ROM) to 15° of knee flexion and allowed to gradually increase this by 10° to 15° per week. The stationary bike to improve knee flexion was added at 3 weeks postoperatively. He began partial weight-bearing activity at 4 weeks postoperatively and progressed to full weight-bearing activity as tolerated. Eventually, elastic tubing for resistance was begun for lower extremity muscle strengthening and closed kinetic chain exercises including squats and lunges were added to assist ROM and strengthening around the knee. Active assisted ROM exercises were instituted at 6 weeks for knee flexion.

The student-athlete was not always consistent with attending rehabilitation because he lived off-campus.
and securing transportation to therapy sessions was limited at times. Because of these circumstances, his active ROM for knee flexion stalled at 80° and was attributed to scar tissue formation. The patient underwent manipulation under anesthesia at 8 weeks postoperatively to restore full active ROM for knee flexion. A second manipulation to restore knee flexion was repeated 10 weeks later due to additional scar tissue and adhesion formation that limited his end-ROM to 110° for knee flexion. Following this second surgical manipulation, the patient achieved full restoration of knee flexion and progressed accordingly per physician protocol for strengthening and functional activities. The student-athlete underwent reconstruction of the anterior cruciate ligament at 28 weeks post-trauma and completed his therapy without incident. Currently, he has full and pain-free active ROM around the knee, equal strength bilaterally, and is able to participate in all football-related activity while wearing a prophylactic anterior cruciate ligament brace for support and protection.

**DISCUSSION**

According to the literature, traumatic knee dislocations often result in multiple-ligament ruptures and associated meniscus lesions. This is consistent regarding knee dislocations that are self-reducing or clinically reduced in emergency department settings. It has been reported that multiple-ligament knee injuries from athletic accidents have a lower reported association with neurovascular injuries and fractures than motor vehicle accidents. A complete rupture of the ITB has not been commonly recognized in the literature as being significant as it relates to traumatic knee dislocation injuries. As noted earlier, only 5 cases of ITB ruptures were found in the cases presented by Mansour et al. When an ITB rupture was discovered by Mansour et al., it was in association with cruciate ligament and posterior lateral corner disruption.

Knee dislocation type injuries are rare. The definitive management of the knee with multiple-ligament injuries remains a controversial topic because no set protocols exist for the timing of repair and the pattern of repair. Most authors agree that knee dislocations with injuries to the lateral side require surgical treatment, but there is little consensus on the best treatment strategy. Some surgeons will advocate surgical repair of all torn structures in combination with reconstruction of the anterior and posterior cruciate ligaments. A two-stage strategy of posterior cruciate ligament repair with collateral ligaments and soft tissues, followed by reconstruction of the anterior cruciate ligament has also been

<table>
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<th>Time Frame</th>
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| 0 to 2 weeks | Knee immobilizer  
NWB with crutches  
Ice and EMS for pain and edema control  
Isometric straight leg raises  
(add weight as tolerated)  
Ankle pumps  
Patella mobilizations |
| 2 to 4 weeks | Knee brace (unlock as ROM improves)  
Continue previous exercises  
Knee flexion PAROM to 15°  
(increase 10° to 15° degrees per week)  
Stationary bike  
Begin PWB (week 4)  
(increase each week as tolerated) |
| 4 to 8 weeks | Continue previous exercises  
Begin AROM/AAROM (week 6)  
CKC exercises (mini-squats, lunges, wall sits, etc.)  
Goal is full AROM/AAROM and no crutches |
| 8 to 12 weeks | Continue previous exercises  
Begin isotonic lower extremity strengthening  
Step-downs/step-ups |
| 12 to 20 weeks | Continue previous exercises  
Begin walk to run program  
Begin functional progressions (week 16) |

NWB = non-weight bearing; EMS = electrical muscle stimulation; ROM = range of motion; PAROM = passive assisted range of motion; PWB = partial weight bearing; AROM = active range of motion; AAROM = active assisted range of motion; CKC = closed kinetic chain
employed with success by surgeons. Regardless of which surgical approach is taken, it is essential to have patient compliance with the rehabilitation plan of care. Otherwise, the risk of scar tissue adhesions increases, which will delay the recovery process.

Despite numerous studies and opinions describing various surgical techniques to treat knee dislocations with injuries to the lateral side, few studies have reported long-term outcomes or have uniform results. Tzurbakis et al. and Eranki et al. noted that most authors advocate the surgical management of these injuries in the acute phase and it is generally recommended that repair should be done within the 3 weeks prior to scar formation.

This case demonstrates the necessity of prompt recognition and treatment of a traumatic knee dislocation injury. Knee dislocations result in multiple-ligament injuries and instability. Gross laxity to the medial and/or lateral collateral ligaments may be indicative of rupture to the anterior and posterior cruciate ligaments. Additionally, positive Lachman, Pivot Shift, and/or Varus Stress tests will exhibit gross instability to the knee joint. These concepts appear to match the data in the study by Terry et al., which indicates that injury to the components of the iliotibial tract tend to correlate with variations in grades of displacement produced by the examination tests used to detect anterior cruciate ligament tears (ie, the Lachman, Pivot Shift, and Varus Stress tests). These factors should encourage the clinical practitioner to consider ITB involvement with traumatic knee injuries, particularly in those involving the anterior and/or posterior cruciate ligaments. Multiple-ligament injuries diagnosed as knee dislocations can reduce spontaneously and one must be vigilant for neurovascular compromise and the possibility of an ITB rupture in the differential diagnosis. This case study supports the immediate care and operative management of a knee trauma resulting in multiple-ligament injuries with an associated ITB rupture.

The ITB rupture associated with an acute knee dislocation case presented herein demonstrates the typical history, evaluation, appropriate treatment, and care of such injuries. Knee dislocations are a result of multiple-ligament injuries and the ITB may also be disrupted, especially with extreme varus laxity on initial examination. Sports medicine providers must evaluate for and consider the possibility of ITB disruptions with acute knee dislocation events. Regarding knee dislocation trauma, most authors recommend immediate surgical repair of the posterior lateral complex of the knee, either in association with reconstruction of the anterior cruciate ligament or through designating such reconstruction as a follow-up surgery once the posterior lateral complex is healed. Fortunately, our patient had no neurovascular impairments and successfully underwent two-stage surgical reconstruction procedures with a positive outcome.

REFERENCES