CHAPTER 2

LITERATURE REVIEW

Injuries to the collateral or cruciate ligaments or to menisci are difficult to account for entirely since many are diagnosed without imaging or arthroscopic confirmation and many go undiagnosed. Data collected through surveys of athletes participating in organized sports or information collected at sports medicine clinics provide the most reliable data, but do not represent the true spectrum of meniscal and ligamentous knee injuries. The incidence of anterior cruciate ligament injury varies widely, depending on the population. The incidence of ACL injury in San Diego was 0.38 per 1,000 members per year, the same as the study in Denmark (16, 17). Many of the ACL injuries were sports related. The incidence of ACL injury is significantly higher in persons engaging in high-risk sports, that involving in jumping, cutting, decelerating and changing direction suddenly, such as soccer, rugby football or basketball, than in the general population.

An ACL injury is usually accompanied by a rapid hemarthrosis. The presence of an acute hemarthrosis usually indicates a cruciate ligament injury, either ACL or PCL, although it may also be associated with chondral fracture, patellar dislocation, peripheral meniscal tear, or intra-articular fracture.

The purpose of the clinical examination is to make a correct anatomic diagnosis. Most experts recommend initiating the examination of the patient by focusing first on the leg that is healthy while the patient assumes a position that makes him/her most comfortable. Examining the healthy knee first creates trust that the examiner is not trying to cause pain and distracts the patient somewhat from the actual maneuvers, allowing greater relaxation. The healthy knee must be examined because an essential component of interpreting the findings in the affected knee is the comparison.

The Lachman test is the one of physical examination maneuvers commonly used to assess the integrity of the ACL. Although the patient may be fearful, this test should not cause pain with isolated ACL injuries in the subacute setting.

Lachman test is typically performed while the patient lies supine with the knee flexed to 20° to 30° (13). The examiner stands to the side of the patient's leg with the patient's heal on the examination table. The femur is grasped with one hand just above the knee. While the examiner grasps the femur firmly to prohibit motion of the upper leg and to relax the hamstrings, the other hand grasps the proximal tibia. The lower leg is then given a brisk forward tug and a discrete end point should be felt. A positive test is one in which the end point is not discrete or there is increased anterior translation of the tibia.

The test is more difficult to perform when the examiner has small hands or the patient has large legs, both situations making it more difficult to completely grasp the legs. In this situation, the patient may be placed prone with the knee at the same degree of flexion while the examiner attempts the same motion of the tibia.

Three researchers reported on the composite examination for ACL injuries without giving data for specific examination maneuvers (18-20). These investigators found that the sensitivity of the examination for ACL injuries was more than 82% and the specificity was more than 94%. The summary likelihood ratios (LRs) for these studies were 25.0 (95% CI, 2.1-306.0) for a positive examination and 0.04 (95% CI, 0.01-0.48) for a negative examination. Other studies (1, 2, 11, 15, 21-26) examined the anterior drawer, lateral pivot shift, and the Lachman maneuver tests. The methodologic quality of these studies was inconsistent; patients primarily had known ruptured ACLs and underwent subsequent arthroscopy or arthrotomy.

Lee JK et al (11) reported the diagnostic characteristic of Lachman test that the specificity , the sensitivity , the LR for a positive test ,and the LR for a negative test were 89% (95% CI = 67.2 to 96.9), 100% (95% CI = 85.7 to 100), 42.0 (95% CI = 2.7 to 651.0), and 0.1 (95% CI = 0.0 to 0.4). However, the authors reported on a population of patients who underwent MRI and subsequent arthroscopy, thus limiting the generalizability of these findings. The previous studies reported that the sensitivity of Lachman test ranged from 60% to 100% and the mean (SD) was 84% (15%) (2, 11, 15, 23-26).

However, clinical assessment by a skilled examiner is more sensitive and specific than MRI for the diagnosis of ACL tears, isolated meniscal tears, and articular cartilage lesions (14). A potential source of variation in the literature was the experience of the examiner and the precise methods used for conducting the physical examination test. While all of the studies included in this literature review used orthopedic surgeons who are generally experienced in the knee examination, most articles did not quantify the examiners' number of years in practice. If experience is an important determinant of accuracy, the data presented in this review should represent an upper limit. The definitions of an "abnormal" or "positive" physical examination were not always clear from the articles. Also, the reproducibility of the physical examination was unclear and rarely reported.

Donaldson et al suggested that the method of administering the Lachman test could affect the results(2). According to Dehaven, judgements based on the Lachman test are inconsistent when made by inexperienced testers, but such judgments become more reliable as testers become more experienced (1). He also reported that the Lachman test was positive in 80% of nonanesthetized patients. Clinical assessment by a skilled examiner and MRI were both highly specific for the diagnosis of ACL injury (14). Cooperman et al studied the reliability of Lachman test and found that the intertester Kappa value was 0.42 (27). This result indicated that Lachman test judgements had limited reliability.

In isolated ACL injury, improvement of symptoms will often occur within a ten-day period, and patients may perceive that they have fully recovered from their injury. If they do not get a correct advice, they will subsequently experience a re-injury. Many of ACL injuries were overlooked and diagnosed as a first-degree ligament sprain and got poor result (28).

With the increasing popularity of testing anterior-posterior knee instability with the patients in the near-extension position, stress radiographic documentation of anterior-posterior motion limits in the extended knee position attracted attention. A comprehensive study of cruciate ligament function in 138 patients using stress radiography of the knee in the extended position was conducted by Staubli et al (29). In subsequent prospective, Staubli and Jakob compared arthrometric measurements and

simultaneous stress radiography in 16 patients with chronic ACL deficiency knees (30). Thirteen of the 16 patients were diagnosed accurately on stress radiography. From this study, they concluded that radiographs obtained under an 89-N anterior force level and under standard conditions provide a reproducible way of documenting the exact anterior tibial position in relation to the femur in ACL deficient knees. However, their study used a specially designed instrument, the Telos machine (Telos GmbH, Hungen/Obbornhofen, Germany), to control a knee position and applied force and the patients were in supine position.

Cadaveric and clinical experiments on knees have shown a striking parallel side to side laxity profile. In some individuals the knees are loose and in others the knees are tight, but the same individual usually shows little difference between knees (8). The side to side measurement difference is relatively more important than the amount of anterior translation. Daniel and Stone had determined that a left/right difference of less than 3 mm with 20-lb. or manual maximum force is associated with a normal ACL in 95% of all cases (31).

According to cadaveric studies, isolated tear of anteromedial bundle, or posterolateral bundle could not be detected by arthrometry or physical examination (32, 33). In these partial tear ACL patients, they have no functional instability so they do not need reconstructive surgery of ACL. For those who sustained complete torn ACL, the need for surgery depends on functional instability and the expectation of future activity that may risk for symptomatic giving way or not. Severity of knee laxity is not the indicator for surgical treatment (34).