Epidemiology and Diagnosis of Anterior Cruciate Ligament Injuries

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KEYWORDS

• ACL • Epidemiology • History • Physical examination • Mechanism of injury • Diagnostic imaging

KEY POINTS

- The incidence of anterior cruciate ligament injuries is 120,000 annually in the United States, and slowly increasing, especially among female athletes. Forty-one percent of these injuries are from noncontact mechanisms.
- The incidence of ACL noncontact injuries may be significantly reduced by enrolling young athletes in jump-training programs.
- Key questions to include on history taking are presence of continuous effusion, popping sensation during trauma, and sensation of giving way.
- The most accurate physical examination test is the Lachman test.
- Although radiographs are important to rule out associated injuries, the gold standard for diagnosis of ACL injuries is MRI, which has shown excellent accuracy.

INTRODUCTION

More than 120,000 anterior cruciate ligament (ACL) injuries occur every year in the United States, mostly during the high school and college years.[1] The incidence of these injuries is slowly increasing, especially in females. This is likely caused by their increasing participation in high school and other organized sports. In addition, several studies have shown that female athletes are at an increased risk of ACL injury in sex-comparable sports.[1] The reason for this increased risk is likely multifactorial including

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such factors as genetic predisposition, hormone levels, narrower notch width, and differences in cutting and landing biomechanics. Diagnosis of these injuries in the acute setting is challenging as the physical examination is less reliable because of joint swelling and muscle guarding. Nonetheless, a focused history and physical examination are essential tools in diagnosing an ACL injury. Radiographs are useful to rule out associated injuries, but the gold standard to diagnose an ACL injury is MRI, which has been shown to have excellent sensitivity and specificity. A better understanding of the risk factors for injury and more accurate diagnoses could facilitate prevention of ACL injuries in active individuals and thus minimize subsequent meniscal and cartilage damage in patients that are ACL deficient.

EPIDEMIOLOGY

Knee injuries in high school athletes account for 60% of sport-related surgeries.[2,3] According to some studies, ACL injuries may account for 50% of all of these knee injuries.[4] According to the Centers for Disease Control and Prevention, in 2006 ACL reconstruction surgery costs were estimated to be nearly $1 billion.[5] More recently, epidemiologic studies have shown that female high school athletes have a 2.1- to 3.4-fold increased risk of ACL injury for sex-comparable sports.[5,6]

To provide an evidence-based incidence and yearly risk of ACL tears in high school athletes, Gornitzky and colleagues[1] performed a systematic review and meta-analysis. In their study, they found an overall incidence in females of 0.081 ACL injuries per 1000 exposures for all sports combined. The riskiest sports for women were soccer and basketball with a risk of having an ACL injury of 1.1% and 0.9% per season, respectively. In male athletes, the overall incidence of ACL injuries was 0.05 per 1000 exposures. The riskiest sports were football and lacrosse with 0.8% and 0.4% risk of having an ACL injury per season, respectively. Female athletes had an overall higher rate of injury per exposure (relative risk, 1.57; 95% confidence interval [CI], 1.35–1.82) than male athletes and in comparable sports, such as soccer and basketball, the rates were much higher (3.7 and 3.8, respectively). When one considers these sport-specific seasonal risks in the context of a multisport athlete over a 4-year span, overall risk of suffering an ACL tear during a high school career can reach 5% to 10%.

Many studies have reported that most ACL injuries are by noncontact mechanisms.[7–9] These findings were challenged in a recent study performed in 100 US high schools by Joseph and colleagues[5] from 2007 to 2012 where they reported that 58.8% of ACL injuries occurred as a result of a contact mechanism. Regardless of the true percentage of noncontact ACLs, a significant proportion of ACL injuries are caused by noncontact mechanisms, making these injuries a major focus for prevention efforts. In a retrospective study focused only on noncontact primary ACL injuries, Beynnon and colleagues[6] showed that college athletes had significantly higher injury risk than high school athletes after adjustment for sport and sex (relative risk, 2.38; 95% CI, 1.55–3.64).

When considering patients that have had a previous ACL reconstructions, studies have provided two important findings. The first is that in the first 2 years of surgery, patients have a similar risk of injuring their contralateral ACL or tearing their graft.[10] The second finding is that patients who have had a previous ACL injury have a significantly increased risk of having a second ACL injury with rates ranging from 4- to 25-fold.[11] It has been shown that returning to a high level of activity after an ACL reconstruction is a strong risk factor for retearing the graft.[12,13] These epidemiologic studies are incredibly important in identifying risk factors involved in ACL injury and providing