Bilateral Anterior Cruciate Ligament Tear in Identical Twins: A Case Report

Kelsey Lyle MAT, LAT, ATC
Oklahoma State University Center for Health Sciences

Jennifer L. Volberding PhD, LAT, ATC
Oklahoma State University Center for Health Sciences

Imram Aktar DO
Oklahoma State Medical Center

Clint. J. Basener DO
Integrity Surgical Associates

Abstract
Anterior cruciate ligament injuries occur at a rate of about 8.1/100,000 per year.[1] They are known to be more common in females with four to five times increased risk of rupture in female athletes. There have been limited studies addressed at risk factors for increased occurrence of ACL rupture in twins. We present a literature review and a case presentation of two female identical twins that had bilateral ACL tears within a span of two years.
Keywords: Epidemiology, injury predisposition, surgical outcomes

Introduction

Anterior Cruciate ligament (ACL) injuries are extremely common among young athletes. Injury rates are estimated to be as 2.8 and 3.2 injuries per 10,000 female college athletes.[2] ACL injuries are multifactorial and research is ongoing outlining numerous risk factors in athletes as well as nonathletes.[3-6] These risk factors include both intrinsic and extrinsic factors.[3] Intrinsic factors include anatomic, developmental, previous injury, activity level, and genetics.[3] For instance, female gender is associated with an increased risk for ACL injury when compared to males.[7] An explanation of increased incidence in women include a smaller ACL, decreased ligamentous stiffness, anatomic differences, and variations in neuromuscular control.[7-9] Genetics can also play a role in placing some athletes at a higher risk for injury.[3-6] One particular study found certain collagen gene variants can determine joint laxity along with ACL injury risk.[4] Another previous study correlated that patients with ACL injuries were twice as likely to have a family member with a previous ACL injury.[6] To our knowledge there has been no previous described case report of bilateral ACL tears in identical twins. We describe these injuries, treatment plan and recovery as well as review possible risk factors for such tears.

Case Presentation

Medical History and Injury

Patients are identical teenage female twins who have both suffered bilateral ACL tears between the ages of 16 and 18. Both individuals had traditional medical histories which did not have any contributing factors associated with ACL injuries. Both patients were active in sports, one in track and field and the other in basketball. The major difference between the two twins injuries is the mechanism by which the injuries happened. One patient reported the mechanism for both

ACL injuries to be twisting. The other patient reported a twisting movement for one leg and a knee hyperextension injury for the other leg (injuries occurred at different time points).

Treatment

Both twins eventually received surgical treatment for both ACL injuries. The patients successfully received patellar tendon grafts for both right and left ACL surgeries. Post operatively they had no signs of graft impingement. They were slowly transitioned into rehabilitation as tolerated at six weeks postoperatively. After rehabilitation they both were able to make a full recovery and return to activity. Both patients had negative drawer and Lachman's test postoperatively bilaterally.

Surgical Results

The twins both suffered from bilateral ACL tears between 16 and 18 years of age. They were both active in high school sports, one in track and field and the other in basketball. They had similar mechanisms of injury for both right ACL injuries but one twin suffered a hyperextension injury on her left knee that led to the ACL injury. The twins both received invasive surgical treatment with patellar grafts and made full recoveries.

Discussion

There are many factors when it comes to why ACL injuries occur. Due to the fact that both twins had bilateral ACL injuries within the same two-year period, there is likely an increased shared genetic or environmental risk factors. Female athletes have 3.5 times increased risk for ACL tear while playing basketball and 2.67 times greater for soccer.[10] We will discuss some possible etiologies of the increased risk factors.

Previous studies have looked into family history and increased risk of ACL tears. One study looked at data from medical history questionnaire to screen for ACL tears in primary family members. There was a 35% incidence of family history of ACL tears in patients with ACL tears compared to a 4% incidence in control group.[11] Our patients did not have any family history of ACL tear in primary family.

One study has attempted to identify exact genetic mutations that can increase ACL tear risk. The study identified a rare TT mutation on COL1A1 gene in white South African patients. COL1A1 study codes for Type I collagen that is a component of ligaments, including ACL.[12] TT mutation was protective compared to population averages for ACL tear. However, CC genotype mutation in COL5A1 gene has been found to increase risk for ACL tear in females.[13] COL5A1 gene codes for type V collagen. There is also an increased incidence of AA genotype of the COL12A1 AluI polymorphism in female athletes with ACL tears. Col12A1 codes for proteins found in type XII collagen.[14] Further research in identifying genetic influence of ACL tear is ongoing and may one-day lead to more personalized preventative measures based on individual mutations.

Previous ACL injuries also increase risk of either repeat injury to ipsilateral or contralateral knee in noncontact sports.[15] One study looked at this increased risk in Australian football players. Patients who had previously injured their ACL in last 12 months were approximately 11 times more likely to re-injure same or contralateral knee compared to their peers. All secondary injuries occurred through non-contact mechanisms. The marked increased risk in re-injury or injury to contralateral side is a cause of concern. It lends itself to increasing preventative measures like muscle strengthening and activity modification to prevent secondary injuries. However, activity modification may be difficult to achieve in high performing athletes.

Clinical Bottom Line

The report identifies a rare occurrence that has yet to be described in published literature. Bilateral ACL tears in identical twins within a span of two years, between the ages of 16-18, highlights the increased risk of secondary injury after initial ACL tear. Influence of local environment versus genetics as the primary cause of tear is up for debate but is likely multifactorial. The identical twins both suffered from bilateral ACL injuries. We identify the need for increased research as well as establishing defined preventative measures once an ACL injury has occurred to reduce risk of secondary injury. We believe it is prudent to provide patient counseling, muscle strengthening exercises and activity modification in active patients with personal or primary family history of ACL tears.

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