

ACL TEARS IN COLLEGIATE WRESTLERS: REPORT OF SIX CASES IN ONE SEASON

Andrew J. Lightfoot, B.S.; Todd McKinley, M.D.; Matthew Doyle, M.S. ATC; Annunziato Amendola, M.D.

ABSTRACT

Six NCAA Division I wrestlers at The University of Iowa tore an anterior cruciate ligament (ACL) during the 2002-03 season. In comparison, between the years of 1993 and 2002, only five wrestlers sustained the same injury. Retrospective review and video data analysis were performed. All six were injured while their knee was near terminal extension and in a vulnerable position. Eighty-three percent of all injuries occurred during takedowns. Five of the six wrestlers' mechanism of injury involved rotation and stress on the weight-bearing knee. Eighty-three percent sustained their injuries while their foot was firmly planted on the ground. Five of the injuries occurred in competition. Of the six wrestlers injured, four underwent immediate rehabilitation in hope of wrestling that same season. Three ultimately needed surgery and one continued to wrestle in the same season without having surgery. Of the five wrestlers who underwent surgical reconstruction of their ACL, each had bone-patellar-bone grafts.

INTRODUCTION

Wrestling continues to be popular, with the number of wrestlers at the collegiate level at over 6300 participants from 257 different schools.¹ In comparison to other major sports, wrestling has received little attention with respect to injury rate, and in particular, ACL injuries. In wrestling, injury rates are relatively high with overall per 1000 athlete-exposures averaging 27/1000 in competition, and 6/1000 in practice, depending

on the study.^{1,4} An athlete exposure occurs when one athlete is exposed to the risk of injury while participating in one competition or one practice. According to Jarret et al.,¹ who looked at injuries that occurred in NCAA sports over an 11-year period, wrestling finished second only to spring football for the highest rate of injury at 9.6 injuries per 1000 athlete-exposures.¹ Some studies suggest the chance of getting a severe injury in wrestling is high.⁵

Injuries to the knee tend to be severe in wrestling.⁶ Over an 11-year period in NCAA wrestling, 65% of injuries requiring surgery involved the knee. In the same study, 21% of injuries leading to greater than one week absence from competition involved the knee.¹ In several longitudinal studies of collegiate wrestling teams, the knee is the most commonly injured body part.^{1,3,5,7-12}

Although knee injuries appear to be very common in wrestling, ACL tears are not, comprising between 0% and 9.1% of all knee injuries.^{1,3,11-13} Snook followed the University of Massachusetts' wrestling program over a five-year period of time and documented no ACL injuries.¹¹

During a one-year period involving 14 different schools, Pasque et al.³ documented 219 injuries, 38 of which involved the knee. Of the 38 recorded knee injuries, two were ACL tears.³ Similarly, Wroble et al.¹² documented that of 136 injuries sustained by The University of Iowa wrestling team between 1976 and 1982, 64 involved the knee and three were ACL tears.

During the 2002-2003 wrestling season, six elite NCAA Division I wrestlers at The University of Iowa sustained ACL tears. The reasons for this rate of ACL tears in that one year are unclear. The purpose of this study is to report the injury, demographics, and management. Information from athletic trainers, team physicians and orthopaedic surgeons, and the student-athletes were reviewed to identify predisposing factors and implement preventive intervention strategies.

METHODS

Information was gathered from a questionnaire filled out by the head athletic trainer for wrestling, with help from the student-athletes, and from summary reports detailing each individual injury. Descriptive reports on injuries sustained by The University of Iowa wrestling

Department of Orthopaedics and Rehabilitation
University of Iowa Hospitals and Clinics
200 Hawkins Drive
Iowa City, IA 52242

Correspondence:

Annunziato Amendola, M.D.
Department of Orthopaedics and Rehabilitation
University of Iowa Hospitals and Clinics
200 Hawkins Drive
Iowa City, IA 52242
Phone: 319-356-4230
FAX: 319-353-6754
email: ned-amendola@uiowa.edu

team from 1993-2003 were obtained to assess overall incidence of ACL injuries in competitive collegiate athletes.

Two types of summary information from the athletic training staff were used for this review. The first was student-athlete specific. In these summaries the ACL injury was described in detail, including mechanism of injury, time of injury, and physical tests used to determine that the athlete tore his ACL. The second summary received from the athletic training staff described injuries that occurred on the wrestling team between 1993 and 2003. Injury frequencies were calculated, and time loss from practice and competition was also determined.

RESULTS

Clinical Data and Management

At The University of Iowa, the wrestling preseason starts when wrestlers begin intense practices in September, and lasts until the first competition in November. The regular season lasts from mid-November until early March. Finally, the post season runs until mid- to late March, and consists of two tournaments, the Big Ten championships and the NCAA championships.

Of the six wrestlers injured, two were heavyweights and four were middle-weights (149 lb, 157 lb, 165 lb, and 174 lb). One of the wrestlers was a freshman, one was a sophomore, three were juniors and one was a senior. Three of the six wrestlers were starters on the varsity team.

Four of the torn ACLs were in the right leg, and two were in the left leg. Two of the wrestlers had previous knee surgery prior to the ACL injury. One had undergone two surgeries: one for a chondral fracture, and another for plica excision. The other wrestler had a prepatellar bursa excision.

Five ACL injuries occurred during the regular season and one during the postseason. Five of the six wrestlers were injured in competition: one in the first period, three in the second period, and one in the third period. The only practice injury occurred in one wrestler during the final quarter. The mechanism of injury was similar for most of the athletes. Video recordings were available for four of the six wrestlers at the time of injury. Of the six wrestlers, five experienced external tibial rotation with coronal knee stress (either valgus or varus). Five of the six wrestlers had a foot planted firmly on the ground at the onset of injury.

Wrestler 1, while in the neutral position, believes he hyperextended his knee while countering a takedown. No film was taken of this match.

In the neutral position, wrestler 2 rotated his body while keeping his foot planted, externally rotating his

tibia as his opponent fell on his knee applying a valgus force.

In the disadvantage position, wrestler 3 had his leg lifted while his knee was being flexed and a varus stress was applied. This is the only injury in practice. This wrestler is the only wrestler who did not have his foot planted at the onset of injury. There was also no film verification.

Standing in the advantage position, wrestler 4 tripped his opponent with his right leg and his weight-bearing left leg twisted and gave out.

In the neutral position, wrestler 5 was tripped during his match and suffered a knee injury on his weight-bearing right leg.

Wrestler 6 was in the neutral position and, while countering a takedown, he twisted his knee.

Five of the six injuries occurred during takedowns, and the other one occurred in the disadvantage position. Four of the six wrestlers performed rehabilitation to return to competitive wrestling during the same season. Only one wrestler continued to wrestle soon after the injury. Three wrestlers underwent extensive rehabilitation and were eventually able to return to competition that season. The remaining two wrestlers had no intention of returning to competition during the same season and opted to undergo surgical repair of their ACL shortly after the injury. The combined record for all the wrestlers before their injury was 47 wins and 20 losses. The combined record for the wrestlers that attempted to wrestle after the injury was 5 wins and 10 losses. Essentially, five of the six wrestlers opted for surgery. Wrestler 3 was the most successful with a 3-1 record. Wrestler 6 is the only one that opted not to undergo surgery, and continues to function and wrestle at this point with minimal complaints.

After their injury, all six of the wrestlers reported knee instability. All of the wrestlers had moderate swelling around their knee within 12-24 hours after the onset of injury. Upon examination, six of the athletes demonstrated a positive Lachman test, six showed a positive anterior drawer test, and two had a positive pivot-shift test. All six of the wrestlers' MRIs showed a complete proximal injury of their ACL. Furthermore, two of the athletes had other related knee injuries at the time of the ACL injury. Wrestler 4 had a complex tear in his meniscus, and Wrestler 5 had a bucket-handle tear in his meniscus. It should be noted that both of these wrestlers underwent rehabilitation and eventually wrestled during the same 2002-2003 season.

All five athletes who had surgery had arthroscopic bone-patellar-bone reconstructions. None of the wrestlers had any complications, and all are expected to return to wrestling. The rehabilitation staff directed a

physician-approved accelerated postoperative rehabilitation protocol.

University Athletic Injury Demographics

Over the academic year of 2002-03, there were a total of 27 documented injuries on The University of Iowa wrestling team that caused an athlete to miss one or more days of competition and/or practice. Of those injuries, 13 (48%) involved the knee. Six of the thirteen injuries were ACL tears, representing 22% of all of the injuries. Of the 1,354 total days lost to injury, 805 days, or 60%, were lost because of knee injuries. On average, the athletes missed 50 days per injury.

Information gathered from 1993-2002 showed that over that ten-year period, there were a total of 94 knee injuries sustained by wrestlers. Overall, the athletes missed a total of 2,158 days, or roughly 23 days per knee injury. During that time period, there were five ACL tears (5.3% of all knee injuries).

DISCUSSION

Five of the athletes were injured during the regular season and one was injured during the post-season. This is similar to other reports. Jarret et al.¹ reported that most collegiate wrestling injuries occurred in preseason and regular season, not postseason. The average injury rate for each season was 10.1, 9.5 and 4.4 per 1000 athlete exposures. None of the six injuries in this report occurred in the preseason. This may reflect the intensive year-round maintenance of physical conditioning at The University of Iowa by Division I athletes compared to athletes in Division II or Division III competition, which were included in the study by Jarret.¹

The majority of our in-season injuries occurred early in the regular season with four injuries being sustained within the first 30 days of competition. This is similar to the previous findings of Wroble et al.,¹² from our institution. They found that 37 out of 94 injuries in collegiate wrestlers occurred during the first month of season, whereas only ten injuries were noted during the last month of competition.¹² Even though these athletes are well conditioned, they may not be at their peak at the end of preseason. Early in the competitive season, the athlete may not yet be prepared for the added intensity and emotion associated with competition compared to practice. This may partially explain why these injuries occur during competition during the early part of the season.

Five of the athletes in our study were injured in competition and the other was injured during practice. This is similar to previous data showing that average injury rates per 1000 exposures for practice and competition for all collegiate wrestlers, was 5.5 and 24.8, respec-

tively.^{2,4} In our patients injured during competition, one was injured in the first period, three in the second, and one in the third. Others have failed to find a correlation between period of match and injury rate.^{8,12,14} Pasque et al.³ noted that 67% of injuries sustained during practice occurred during the second half of practice. They also found that 78% of injuries during competition were sustained in the second and third periods. Based on the available data, fatigue may mildly predispose competitive wrestlers to ACL injuries.

Three of the six wrestlers injured were in the upper one-third of the weight divisions (one at 174 lbs and two heavyweights). The other three wrestlers were all in the middle one-third of the weight divisions (one at 149 lbs, one at 157 lbs and one at 165 lbs). None were in the three lightest weight classes. Previous studies have not found any association between injury and weight class.^{1,12,15} Wrestling deliberately matches the physical size of competitors, which may explain the lack of correlation between injury and weight class.

Five of the six wrestlers were injured during takedown scrambles, four were countering a takedown and the fifth was attempting a takedown. This compares to other studies documenting that at least 50% and as many as 68% of all wrestling injuries occur during takedowns.^{1,3,5,8,12-13,15} Takedown scrambles are particularly hazardous to the knee,^{8,12} and five of the six ACL injuries in this study occurred during takedowns. Our data reconfirm that takedowns are consistently one of the most dangerous acts involved in the sport of wrestling. Unlike wrestling down on the mat, takedowns likely involve greater inertial forces, thus placing the wrestler at increased risk.

Regardless of the wrestling position (neutral, advantage or disadvantage), each athletes' knee was in or near full extension at the time of injury, thus impairing the leverage of the hamstrings to resist forces applied to the knee by the quadriceps. In general, when the quadriceps muscle contracts, it creates an anterior tibial translation which is countered by the posterior tibial translation of the hamstring muscle contraction.¹⁶ Between 15 and 60 degrees of flexion, the hamstring co-contraction is extremely important in reducing excessive forces exerted on the ACL.¹⁷ As the knee moves closer to full extension, it becomes less effective at countering the quadriceps contraction, and is therefore less able to protect the ACL.¹⁸

All six of the injuries sustained by the wrestlers involved a knee in or near full extension, five of the six injuries involved a rotational knee injury and five of six wrestlers had the foot of their injured leg firmly planted on the ground at the time of injury. These precarious and dangerous positions stemmed from either poor

technique or from the wrestler being acted upon by his opponent.

To the best of our knowledge, no previous study has addressed the success of wrestlers returning to competition after an ACL injury. Four of our wrestlers in this study tried to return to competition in the same season, and only one of four compiled a winning record. This wrestler chose to have his ACL reconstructed after the season due to instability. Two of the other wrestlers chose to undergo surgery because of their lack of success wrestling with an ACL-deficient knee. The fourth wrestler has decided not to have reconstructive surgery and will attempt to wrestle and improve his stability and comfort through rehabilitation.

Retrospective analysis of six ACL tears sustained by collegiate wrestlers from one team suggests that wrestlers are at a greater risk for an ACL tear during competition compared to practice. Wrestling in the neutral position may be the greatest risk factor for sustaining an ACL tear. Wrestlers may be more prone to injury early in the competitive season. Coaches and athletic trainers should emphasize proper technical positioning while wrestling in the neutral position, avoiding positions with the knee near full extension. Our data suggest it is difficult to return to competitive wrestling with an ACL-deficient knee, even after extensive rehabilitation.

REFERENCES

1. **Jarret GJ, Orwin JF, Dick RW.** Injuries in collegiate wrestling. *Am J Sports Med* 1998; 26:674-80.
2. **Dick RW.** 2001-02 *NCAA Sports Medicine Handbook*. National Collegiate Athletic Association, 2001.
3. **Pasque CB, Hewett TE.** A prospective study of high school wrestling injuries. *Am J Sports Med* 2000; 28:509-15.
4. **Potts KA, Dick RW.** 2000-01 *NCAA Sports Medicine Handbook*. National Collegiate Athletic Association, 2000.
5. **Requa R, Garrick JG.** Injuries in Interscholastic Wrestling. *Phys Sportsmed* 1981; 9:44-51.
6. **Lorish TR, Rizzo TD, Jr., Ilstrup DM, et al.** Injuries in adolescent and preadolescent boys at two large wrestling tournaments. *Am J Sports Med* 1992; 20:199-202.
7. **DeHaven KE, Lintner DM.** Athletic injuries: comparison by age, sport, and gender. *Am J Sports Med* 1986; 14:218-24.
8. **Estwanik JJ, Bergfeld J, Collins HR, et al.** Injuries in Interscholastic Wrestling. *Phys Sportsmed* 1980; 8:111-21.
9. **Garrick JG, Requa R.** Medical Care and Injury Surveillance in the High School Setting. *Phys Sportsmed* 1981; 9:115-20.
10. **Jackson DS, Furman WK, Berson BL.** Patterns of injuries in college athletes: a retrospective study of injuries sustained in intercollegiate athletics in two colleges over a two-year period. *Mt Sinai J Med* 1980; 47:423-6.
11. **Snook GA.** Injuries in intercollegiate wrestling. A 5-year study. *Am J Sports Med* 1982; 10:142-4.
12. **Wroble RR, Mysnyk MC, Foster DT, et al.** Patterns of knee injuries in wrestling: a six year study. *Am J Sports Med* 1986; 14:55-66.
13. **Estwanik JJ, Bergfeld J, Canty T.** Report of injuries sustained during the United States Olympic wrestling trials. *Am J Sports Med* 1978;6:335-40.
14. **Kersey RD, Rowan L.** Injury account during the 1980 NCAA wrestling championships. *Am J Sports Med* 1983; 11:147-51.
15. **Strauss RH, Lanese RR.** Injuries among wrestlers in school and college tournaments. *Jama* 1982; 248:2016-9.
16. **Cowling EJ, Steele JR.** The effect of upper-limb motion on lower-limb muscle synchrony. Implications for anterior cruciate ligament injury. *J Bone Joint Surg Am* 2001; 83-A:35-41.
17. **Li G, Sakane KM, Ma CB, et al.** The importance of quadriceps and hamstring muscle loading on knee kinematics and in-situ forces in the ACL. *J Biomech* 1999; 32:395-400.
18. **Pandy MG, Shelburne KB.** Dependence of cruciate-ligament loading on muscle forces and external load. *J Biomech* 1997; 30:1015-24.