УДК: 616.728.3-001-036.8
HTTPS://DOI.ORG/10.37647/2786-7595-2023-116-1-76-82

Anterior Cruciate Ligament Injury: What Are Trends in Treatment?

Zazirnyi I.M.[1]✉, Andreev A.[2], Kostrub O.O.[3], Kotiuk V.V.[3]

Summary. *There has been a reemergence of investigation into Anterior Cruciate Ligament (ACL) repair as a surgical option for patients presenting with an ACL rupture. Despite high historical failure rates, new innovations have been implemented to improve stability and biointegration in an effort to aid healing of the ligament and decrease failure rates following ACL repair. The evolution of surgical techniques has seemingly led to improved short-term outcomes over historical reports. However, there remains a paucity of literature on long-term outcomes, large series, and comparison among repair techniques. Furthermore, there have been no high-quality studies showing outcomes comparable with those after ACL reconstruction. While advancements in ACL repair have been encouraging, there are no data, to our knowledge, to support ACL repair over ACL reconstruction, as recent reports have shown high failure rates after ACL repair. For these reasons, at the present time, ACL reconstruction should remain the gold standard treatment for patients with functional impairment from an ACL rupture. In the future, there may be a role for ACL repair for select tear types in specific individuals, if the early ACL repair outcome studies produce consistent long-term outcomes comparable with those after ACL reconstruction.*

Key words: *ACL; anterior cruciate ligament; injury; treatment; rehabilitation.*

Introduction

Anterior cruciate ligament (ACL) tears represent more than 50% of knee injuries and affect more than 200,000 people in the United States each year, with direct and indirect costs greater than $7 billion annually [1]. Young persons participating at high levels of competition are at particular risk; 40% of injuries are attributed to noncontact mechanisms involving pivoting, cutting, or jumping [1].

ACL injuries are associated with several modifiable and nonmodifiable risk factors, including female sex [2] (with risk three times as high as that associated with male sex), young age (with a peak at 16 to 18 years), and earlier, more intense, and more frequent participation in sports [3]. Variations in bone morphology, neuromuscular control, genetic profile, and hormonal milieu may play a role [4]. A recent systematic review and meta-analysis of ACL injury reported an incidence of 0.08 in female athletes and 0.05 in male athletes per 1000 exposures, with soccer posing the greatest risk of ACL injury in female athletes (1.1% per season) and football in male athletes (0.8% per season) [4]. ACL injuries are often complicated by concomitant injury of the medial collateral ligament (19 to 38%) and lateral (20 to 45%) or medial (0 to 28%) meniscal tears [1].

1. Assessment and Diagnosis

Patients with ACL tears typically present with acute injury, sometimes with an associated “pop,” a sensation of tearing, the immediate onset of effusion, or any combination thereof. Several maneuvers are useful in diagnosis when ACL injury is suspected on physical examination. In the anterior drawer test, the examiner moves the tibia forward with respect to the femur, with the patient’s knee at 90 degrees of flexion and the feet flat; excessive anterior translocation indicates a positive test. Better tests are the Lachman test and the pivot-shift test, which have reported respective sensitivities of 0.87 and 0.49 and specificities of 0.97 and 0.98 [5]. The pivot-shift test is a dynamic test of the rotatory laxity of the knee that produces subluxation and reduction (felt as a “clunk”) of the lateral tibial plateau [5]. Quantitative pivot-shift testing, in which either translation of the lateral plateau or tibial acceleration is measured, has been validated in a clinical trial

✉ *Zazirnyi I.M., zazirny@ukr.net*
[1]Clinical Hospital “Feofaniya” of the Agency of State Affairs, Kyiv
[2]Orthopedics and Traumatology Department, University Multiprofile Hospital for Active Treatment “Santa Anna”, Sofia, Bulgaria
[3]SI “Institute of Traumatology and Orthopedics of NAMS of Ukraine”, Kyiv

and can be used to assess concomitant soft-tissue injuries [6]. Although plain radiography is often the first diagnostic step after the physical examination to rule out fracture, dislocation, or both, magnetic resonance imaging (MRI) is strongly recommended as part of the diagnostic evaluation, given its reported high sensitivity and specificity (97% and 100%, respectively) for the detection of ACL injury [7]. MRI can also be used to identify associated damage to the meniscus, articular cartilage, and collateral ligaments, any of which, if present, will influence the treatment approach [1].

2. Treatment

ACL reconstruction has traditionally been recommended for the restoration of anterior–posterior as well as rotatory knee laxity in young, healthy patients with the desire to engage in pivoting sports (including alpine skiing, baseball, basketball, football, handball, hockey, lacrosse, soccer, and tennis) at a highly competitive level [8].

However, in a randomized trial involving active young patients that compared the outcomes of early ACL reconstruction (i.e., within 10 weeks after injury) with delayed reconstruction (with the inclusion of structured rehabilitation in both groups), no statistically significant between-group differences were reported in average scores on four subscales of the Knee Injury and Osteoarthritis Outcome Score (KOOS): pain, symptoms of instability, function in sports and recreation, and knee-related quality of life [9]. There were also no statistically significant between-group differences in scores on these subscales of the KOOS at 5 years15 or in the incidence of meniscal tears requiring surgery or the incidence of radiographically confirmed arthritis [10].

Many patients were high-level athletes, with a median Tegner activity score of 9, which indicates competitive athletic involvement (scores range from 0 to 10, with a score of 0 indicating sick leave or disability, a score of 5 indicating participation in recreational sports, and a score of 10 indicating participation in competitive sports on a professional level). However, the trial was relatively small (with a total of 121 patients) and excluded patients who had complete collateral ligament injuries or full-thickness cartilage defects or who required meniscal fixation [10].

In addition, half the patients in the optional reconstruction group pursued delayed ACL reconstruction, and those treated nonoperatively had greater knee laxity and more meniscus injuries at final follow-up (13 vs. 1) than those treated operatively.

In another report, a matched-pair analysis involving 50 high-level athletes who did or did not undergo ACL reconstruction, those who had reconstruction had less knee laxity than those who did not have reconstruction, but there were otherwise no statistically significant differences in clinical outcomes or costs [11]. Although high-level evidence in favor of surgery is lacking, surgery is recommended as the initial treatment for top-level athletes (Tegner activity score of 10).

2.1. Nonoperative Therapy

Nonoperative therapy involves 3 months of supervised physiotherapy; anti-inflammatory medications; range-of-motion training; gradual strengthening of the quadriceps, hamstrings, hip abductors, and core muscles; and a progressive return to activity. Reevaluation is recommended 6 to 12 weeks after the initial injury to assess the effectiveness of rehabilitation and to consider the need for delayed ACL reconstruction [12]. Functional braces have not been shown to provide adequate restoration of stability [13].

2.2. Operative Treatment
2.2.1. Timing of Surgery

A systematic review that included 3583 patients from observational studies suggested that no statistically significant differences in subjective or objective measures of outcome were related to the timing of ACL surgery [14]. However, the timing of surgery may affect the development and severity of related soft-tissue damage.

A retrospective study in which early ACL reconstruction (i.e., within 12 weeks after injury) was compared with later reconstruction showed higher rates of damage to medial meniscal and medial tibiofemoral cartilage in the group receiving later treatment [15]. Similarly, another observational study that included more than 5000 patients showed that the risk of medial meniscal surgery was twice as high when ACL reconstruction was delayed for more than 5 months after injury and six times as high if delayed for more than 1 year; these risks appeared to be greater among patients younger than 17 years of age [7]. It has been hypothesized that restoring anterior–posterior and rotatory knee laxity may prevent subsequent instability and resultant damage to articular cartilage, the meniscus, or both.

The American Academy of Orthopaedic Surgeons evidence-based guideline on the management of ACL injuries recommends 12 weeks of nonoperative treatment for acute isolated ACL tear followed by a reevaluation of the need for surgery. When ACL

reconstruction is indicated, the guidelines recommend that surgery be performed within 5 months after injury to avoid recurrent instability and resultant additional damage to the meniscus, articular cartilage, or both [16].

2.2.2. Complications of ACL Reconstruction

The most common complication of ACL reconstruction is superficial wound infection, which occurs in less than 1% of patients. Less common complications include deep joint infection and postoperative hemarthrosis, and the latter sometimes results in quadriceps inhibition (inability to actively contract the quadriceps muscle) [17]. Loss of motion can also occur as a result of incorrect positioning of the graft (the most common surgical error) or arthrofibrosis (the formation of excessive scar tissue within the joint and in surrounding soft tissues, leading to painful restriction of joint motion).

2.3. Surgical Technique

Randomized trials of primary ACL reconstruction have shown that autografts of the hamstrings (the tendons of the semitendinosus and gracilis muscles) and the patellar tendon have similar results, patient-reported outcomes, and incidences of postoperative osteoarthritis on radiography [7, 18]. The quadriceps tendon is another potential source for grafting and is associated with less damage at the site of tendon harvest than grafts of the patellar tendon and with similar patient-reported outcomes [19]. As compared with autografts, allografts have higher costs and higher rates of graft failure and repeat rupture of the ACL, particularly in young athletes [20]. As such, autografts remain the preferred source [21]. Either single-bundle or double-bundle reconstruction, both of which involve both anatomical bundles of the ACL, can be used in ACL reconstruction [18, 22].

The risk of revision of ACL reconstruction is lower with double-bundle reconstruction (2.0%) than with single-bundle reconstruction (3.2%), but single-bundle reconstruction is less costly [21]. The results of randomized trials suggest that the choice of surgical tunnel drilling technique (transtibial vs. anteromedial portal) is not associated with a statistically significant difference in clinical outcomes [23].

Meniscal injuries occur in 26 to 45% of patients with ACL injuries, most commonly in the posterior and peripheral regions. Case series of meniscus repair at the time of ACL reconstruction have reported good clinical outcomes, exceeding 90% at a minimum of 5 years of follow-up [24].

Concomitant collateral ligament injuries occur in 19 to 38% of patients with ACL injuries. Management of concomitant collateral injuries is determined in part by the laxity of the ligament with axial rotation and the response to varus and valgus stress tests. The most severe injuries to the collateral ligament (grade 3 on a scale of 1 to 3) often require surgical treatment [25].

When ACL injury is associated with injuries to multiple ligaments of the knee, the available evidence (which is observational) supports early surgical management of all damaged ligaments, arthroscopic ACL reconstruction, and primary open reconstruction of collateral ligaments, either concomitantly or as the first of a two-stage ACL reconstruction procedure.

2.4. Rehabilitation

Postoperative rehabilitation follows the same general principles as those described above in relation to nonoperative treatment. Rehabilitation programs consist of measures to establish full range of motion, prevent muscle hypotrophy, diminish pain and swelling, and avoid unnecessary stress to the reconstructed ligament and to any meniscal cartilage repairs.

Rehabilitation starts within the first week after surgery, continues for 6 to 9 months, with two or three sessions per week, and includes the following: cryotherapy (ice and compression of soft tissue with an elastic bandage to reduce swelling), immediate weight bearing as tolerated by the patient, eccentric quadriceps strengthening (in which the patient lowers the leg from an extended position against resistance), isokinetic hamstring exercises (contraction at constant speed), closed kinetic-chain (foot is fixed and cannot move) and open kinetic-chain (lower leg swings free) exercises, and neuromuscular and agility training (training geared toward reestablishing muscle control, dynamic joint stability, and movement patterns opposite to those shown to injure the ACL [i.e., avoiding dynamic valgus, which is characterized by the medial or internal collapse of the knee]).

3. Return to Play

Whatever the approach to therapy, the patient's activity level may decline after an ACL tear. The athlete's goal after ACL injury is to return to the same level of play (the same Tegner activity level) achieved before surgery. Data suggest that only 40 to 55% of patients return to the same level of activity or higher after undergoing ACL surgery [26]. According to the findings in one randomized trial, the activity level on return to play was on average two Tegner levels below that before injury, independent of treatment choice.

However, in a study assessing return to play among European professional soccer players after ACL reconstruction (who presumably had high

motivation to return to play and excellent resources for rehabilitation), the rate of return to play was 93%, with 65% of players returning at the same level reported before injury [27].

Although data from randomized trials to guide the timing of return to sports are lacking, it is generally accepted that return should be delayed for a minimum of 9 months from surgery to optimize biologic graft incorporation and clinical outcomes [28]. Clearance to return should be based on the player's ability to meet the criteria for return-to-play protocols (e.g., symmetric quadriceps strength and symmetric performance in hop tests). In a cohort study of athletes who underwent ACL reconstruction, rates of reinjury within 2 years were 4.5% in those who met the criteria for return to play and 33% in those who did not (P = 0.08). Rates of injury were also significantly higher in those who returned to play before 9 months [41]. Negative psychological responses (e.g., absence of mental readiness for return to sport or competition) are associated with a lower rate of return to the preinjury level of play after ACL reconstruction [29].

4. Injury Prevention

There are some ACL injury prevention strategies.

Bracing has been proposed as a means of reducing ACL injury, since the ligament may be subject to much lower peak strain in a functional brace, as has been suggested with the use of a motion-capture system in evaluations of an athlete at high risk for ACL injury [30]. A randomized trial involving more than 21,000 athlete exposures in football (i.e., time on the field, in practice or in game play) showed a significant reduction in overall knee injuries with the use of a prophylactic knee brace, but there were too few ACL injuries to determine whether the brace was beneficial for this specific injury [31].

In meta-analyses of preventive training programs focused on sport-specific training, biomechanics, and proprioception, the programs were shown to significantly reduce the per-season risk of ACL injury [32].

Economic analyses suggest that such programs are associated with cost savings of approximately $100 per athlete per season [33] with 100 patients requiring this intervention to prevent a single ACL injury.

Discussion

There is a need for larger randomized trials with longer-term follow-up in which initial surgery (followed by rehabilitation) is compared with a strategy of initial rehabilitation and delayed surgery, as needed, and in which different approaches to ACL reconstruction are assessed. Data from randomized trials are lacking to guide treatment when there are concomitant meniscal and collateral ligament injuries. Data on long-term clinical outcome are needed to better understand the ways in which treatment of ACL-injured knees, subsequent injuries to meniscus and cartilage, and the development of osteoarthritis are related [34]. Preliminary studies with short-term follow-up have not indicated that any clinical benefit is gained with the use of platelet-rich plasma augmentation, stem-cell therapy, or primary ACL repair (i.e., suturing the torn ACL to the bone as opposed to grafting it) [35].

Guidelines

The American Academy of Orthopaedic Surgeons has guidelines for the treatment of ACL injuries [16].

A. Diagnosis

1. A relevant history and musculoskeletal examination are effective diagnostic tools for injury of the anterior cruciate ligament (ACL).
2. MRI is useful for the assessment of ACL injury and concomitant injury to ligaments, the meniscus, or articular cartilage.

B. Treatment

1. There is limited evidence available to compare the effectiveness of nonoperative treatment of an ACL tear with reconstruction in patients with recurrent instability, but there is support for consideration of ACL reconstruction because the procedure reduces pathologic laxity.
2. There is limited evidence to support nonoperative management for less active patients with less laxity.
3. Either single- or double-bundle reconstruction can be used. Outcomes for the procedures have been shown to be similarly good.
4. Autografts of the hamstrings (the tendons of the semitendinosus and gracilis muscles) and the patellar tendon have been shown to have outcomes that are similarly good [16].
5. Similar outcomes have been reported for autografts and allografts, although the results may not be generalized to all patients [36].

Another opinion was published in 2021 in the British Journal of Sports Medicine. An international consensus group of experts was convened to determine consensus regarding best available evidence on operative versus non-operative treatment for ACL injury at their consensus meeting in 2019 [37].

The expert panel at the ACL Consensus

Meeting Panther Symposium 2019 reached consensus, defined as >80% agreement, on 11 of 12 statements in terms of operative versus non-operative treatment for ACL injuries. Consensus was reached that both treatment options may be acceptable, depending on patient characteristics, including the type of sporting demands and the presence of concomitant injuries. In highly active patients engaged in jumping, cutting and pivoting sports, early anatomical ACL reconstruction is recommended due to the high risk of secondary meniscus and cartilage injuries with delayed surgery, although a period of progressive rehabilitation to resolve impairments and improve neuromuscular function may be recommended. For patients who want to return to straight plane activities, non-operative treatment with structured, progressive rehabilitation is an acceptable treatment option. However, with persistent functional instability, or when episodes of giving way occur, anatomical ACL reconstruction is indicated.

Conclusions

In a recreational athlete, such as the athlete described in the vignette, whose history and results on physical examination suggest an ACL injury, MRI is indicated to confirm the diagnosis and to determine whether there are concomitant injuries. Given the limited data showing that immediate ACL reconstruction and initial rehabilitation followed by surgery (if needed) are associated with similar outcomes in such patients, we would discuss with the patient the option of a supervised, structured, accelerated course of rehabilitation as an alternative to immediate reconstruction. If an initial strategy of rehabilitation were chosen, we would recommend serial evaluation of knee function and functional recovery in the first 3 months after the injury. If residual laxity (greater than grade 2) existed at the time of subsequent assessment, we would favor surgery to avoid further damage to articular cartilage and menisci. We would recommend immediate ACL reconstruction for a top-level athlete with the same injury. Whether or not surgery is performed, we would recommend criterion-based (not solely time-based) assessment before the athlete returns to play in order to minimize the risk of reinjury, contralateral injury, or both.

Conflict of interests. The authors declare no conflict of interest towards the present article.

References

1. Kaeding CC, Léger-St-Jean B, Magnussen RA. Epidemiology and diagnosis of anterior cruciate ligament injuries. Clin Sports Med 2017; 36: 1-8. https://doi.org/10.1016/j.csm.2016.08.001.
2. Ellison TM, Flagstaff I, Johnson AE. Sexual Dimorphisms in Anterior Cruciate Ligament Injury: A Current Concepts Review. Orthop J Sports Med. 2021 Dec; 9(12): 23259671211025304. Published online 2021 Dec17. https://doi.org/10.1177/23259671211025304.
3. Ladenhauf HN, Graziano J, Marx RG. Anterior cruciate ligament prevention strategies: are they effective in young athletes – current concepts and review of literature. Curr Opin Pediatr 2013; 25: 64-71. https://doi.org/10.1097/mop.0b013e32835ad208.
4. Gornitzky AL, Lott A, Yellin JL, Fabricant PD, Lawrence JT, Ganley TJ. Sportspecific yearly risk and incidence of anterior cruciate ligament tears in high school athletes: a systematic review and metaanalysis. Am J Sports Med 2016; 44: 27 16-23. https://doi.org/10.1177/0363546515617742.
5. Huang W, Zhang Y, Yao Z, Ma L. Clinical examination of anterior cruciate ligament rupture: a systematic review and meta-analysis. Acta Orthop Traumatol Turc 2016; 50: 22-31. https://doi.org/10.3944/AOTT.2016.14.0283.
6. Musahl V, Burnham J, Lian J, et al. High-grade rotatory knee laxity may be predictable in ACL injuries. Knee Surg Sports Traumatol Arthrosc 2018; 26: 3762-69 https://doi.org/: 10.1007/s00167-018-5019-y.
7. Sri-Ram K, Salmon LJ, Pinczewski LA, Roe JP. The incidence of secondary pathology after anterior cruciate ligament rupture in 5086 patients requiring ligament reconstruction. Bone Joint J 2013; 95-B: 59-64. https://doi.org/10.1302/0301-620X.95B1.29636.
8. Moksnes H, Engebretsen L, Eitzen I, Risberg MA. Functional outcomes following a non-operative treatment algorithm for anterior cruciate ligament injuries in skeletally immature children 12 years and younger: a prospective cohort with 2 years follow-up. Br J Sports Med 2013; 47: 488-94. https://doi.org/10.1136/bjsports-2012-092066.
9. Roos EM, Roos HP, Lohmander LS, Ekdahl C, Beynnon BD. Knee Injuryand Osteoarthritis Outcome Score (KOOS) – development of a self-administered outcome measure. J Orthop Sports Phys Ther 1998; 28: 88-96. https://doi.org/10.2519/jospt.1998.28.2.88.
10. Frobell RB, Roos HP, Roos EM, Roemer FW, Ranstam J, Lohmander LS. Treatment for acute anterior cruciate ligament tear: five year outcome of randomised trial. BMJ 2013; 346: f232. https://doi.org/10.1136/bmj.f232.
11. Meuffels DE, Favejee MM, Vissers MM, Heijboer MP, Reijman M, Verhaar JAN. Ten year follow-up study comparing conservative versus operative treatment of anterior cruciate ligament ruptures: a matched-pair analysis of high level athletes. Br J Sports Med 2009; 43: 347-51. https://doi.org/10.1136/bjsm.2008.049403.
12. Hetsroni I, Delos D, Fives G, Boyle BW, Lillemoe K, Marx RG. Nonoperative treatment for anterior cruciate ligament injury in recreational alpine skiers. Knee Surg Sports Traumatol Arthrosc 2013; 21: 1910-4. https://doi.org/10.1007/s00167-012-2324-8.
13. Smith SD, LaPrade RF, Jansson KS, Aroen A, Wijdicks CA. Functional bracing of ACL injuries: current state and future directions. Knee Surg Sports Traumatol Arthrosc 2014; 22: 1131-41. https://doi.org/10.1007/s00167-013-2514-z.
14. Andernord D, Karlsson J, Musahl V, Bhandari M, Fu FH, Samuelsson K. Timing of surgery of the anterior cruciate ligament. Arthroscopy 2013; 29: 1863-71. https://doi.org/10.1016/j.arthro.2013.07.270.
15. Magnussen RA, Pedroza AD, Donaldson CT, Flanigan DC,

Kaeding CC. Time from ACL injury to reconstruction and the prevalence of additional intra-articular pathology: is patient age an important factor? Knee Surg Sports Traumatol Arthrosc 2013; 21: 2029-34. https://doi.org/10.1007/s00167-013-2380-8.
16. Shea KG, Carey JL, Richmond J, et al. The American Academy of Orthopaedic Surgeons evidence-based guideline on management of anterior cruciate ligament injuries. J Bone Joint Surg Am 2015; 97: 672-4. https://doi.org/10.2106/jbjs.n.01257.
17. Bohu Y, Klouche S, Herman S, de Pamphilis O, Gerometta A, Lefevre N. Professional athletes are not at a higher risk of infections after anterior cruciate ligament reconstruction: incidence of sep-tic arthritis, additional costs, and clinical outcomes from the French Prospective Anterior Cruciate Ligament Study (FAST) cohort. Am J Sports Med 2019; 47: 104-11. https://doi.org/10.1177/0363546518810527.
18. Björnsson H, Samuelsson K, Sundemo D, et al. A randomized controlled trial with mean 16-year follow-up comparing hamstring and patellar tendon autografts in anterior cruciate ligament reconstruction. Am J Sports Med 2016; 44: 2304-13. https://doi.org/10.1177/0363546516646378.
19. Lund B, Nielsen T, Fauno P, Christiansen SE, Lind M. Is quadriceps tendon a better graft choice than patellar tendon? A prospective randomized study. Arthroscopy 2014; 30: 593-8. https://doi.org/10.1016/j.arthro.2014.01.012.
20. Kaeding CC, Pedroza AD, Reinke EK, et al. Change in anterior cruciate ligament graft choice and outcomes over time. Arthroscopy 2017; 33: 2007-14. https://doi.org/10.1016/j.arthro.2017.06.019.
21. Saltzman BM, Cvetanovich GL, Nwachukwu BU, Mall NA, Bush-Joseph CA, Bach BR Jr. Economic analyses in anterior cruciate ligament reconstruction: a qualitative and systematic review. Am J Sports Med 2016; 44: 1329-35. https://doi.org/10.1177/0363546515581470.
22. Svantesson E, Sundemo D, Hamrin Senorski E, et al. Double-bundle anterior cruciate ligament reconstruction is superior to single-bundle reconstruction in terms of revision frequency: a study of 22,460 patients from the Swedish National Knee Ligament Register. Knee Surg Sports Traumatol Arthrosc 2017; 25: 3884-91.https://doi.org/10.1007/s00167-016-4387-4.
23. MacDonald P, Kim C, McRae S, Leiter J, Khan R, Whelan D. No clinical differences between anteromedial portal and transtibial technique for femoral tunnel positioning in anterior cruciate ligament reconstruction: a prospective randomized, controlled trial. Knee Surg Sports Traumatol Arthrosc 2018; 26: 1335-42. https://doi.org/10.1007/s00167-017-4664-x.
24. Bogunovic L, Kruse LM, Haas AK, Huston LJ, Wright RW. Outcome of all-inside second-generation meniscal repair: minimum five-year follow-up. J Bone Joint Surg Am 2014; 96: 1303-7. https://doi.org/10.2106/jbjs.m.00266.
25. LaPrade RF, Bernhardson AS, Griffith CJ, Macalena JA, Wijdicks CA. Correlation of valgus stress radiographs with medial knee ligament injuries: an in vitro biomechanical study. Am J Sports Med 2010; 38: 330-8. https://doi.org/10.1177/0363546509349347.
26. Ardern CL, Taylor NF, Feller JA, Webster KE. Fifty-five per cent return to competitive sport following anterior cruciate ligament reconstruction surgery: an updated systematic review and meta-analysis including aspects of physical functioning and contextual factors. Br J Sports Med 2014; 48:1543-52. https://doi.org/10.1136/bjsports-2013-093398.
27. Waldén M, Hägglund M, Magnusson H, Ekstrand J. ACL injuries in men's professional football: a 15-year prospective study on time trends and return-to-play rates reveals only 65% of players still play at the top level 3 years after ACL rupture. Br J Sports Med 2016; 50: 744-50. https://doi.org/10.1136/bjsports-2015-095952.
28. van Melick N, van Cingel RE, Brooijmans F, et al. Evidence-based clinical practice update: practice guidelines for anterior cruciate ligament rehabilitation based on a systematic review and multidisciplinary consensus. Br J Sports Med 2016; 50: 1506-15. https://doi.org/10.1136/bjsports-2015-095898.
29. Ardern CL, Taylor NF, Feller JA, Whitehead TS, Webster KE. Sports participation 2 years after anterior cruciate ligament reconstruction in athletes who had not returned to sport at 1 year: a prospective follow-up of physical function and psychological factors in 122 athletes. Am J Sports Med 2015; 43: 848-56. https://doi.org/10.1177/0363546514563282.
30. Hangular G, Brennemann E, Nicholss M, Bakker R, Laing A, Chandrashekar N. Can a knee brace reduce the strain in the anterior cruciate ligament? A study using combined in vivo/in vitro method. Prosthet Orthot Int. 2016; 40: 394-9. https://doi.org/10.1177/0309364615574167.
31. Sitler M, Ryan J, Hopkinson W et al. The efficacy of a prophylactic knee brace to reduce knee injuries in football: a prospective, randomized study at West Point https://doi.org/10.1177/036354659001800315.
32. Donnell-Fink LA, Klara K, Collins JE, et al. Effectiveness of knee injury and anterior cruciate ligament tear prevention programs: a meta-analysis. PLoS One 2015; 10(12): e0144063. https://doi.org/10.1371/journal.pone.0144063.
33. Swart E, Redler L, Fabricant PD, Mandelbaum BR, Ahmad CS, Wang YC. Prevention and screening programs for anterior cruciate ligament injuries in young athletes: a cost-effectiveness analysis. J Bone Joint Surg Am 2014; 96: 705-11. https://doi.org/10.2106/jbjs.m.00560.
34. Cinque ME, Dornan GJ, Chahla J, Moatshe G, LaPrade RF. High rates of osteoarthritis develop after anterior cruciate ligament surgery: an analysis of 4108 patients. Am J Sports Med 2018; 46: 2011-9. https://doi.org/10.1177/0363546517730072.
35. Perrone GS, Proffen BL, Kiapour AM, Sieker JT, Fleming BC, Murray MM. Bench-to-bedside: bridge-enhanced anterior cruciate ligament repair. J Orthop Res 2017; 35: 2606-12. https://doi.org/10.1002/jor.23632.
36. Maletis GB, Chen J, Inacio MC, Funahashi TT. Age-related risk factors for revision anterior cruciate ligament reconstruction: a cohort study of 21,304 patients from the Kaiser Permanente Anterior Cruciate Ligament Registry. Am J Sports Med 2016; 44: 331-6. https://doi.org/10.1177/0363546515614813.
37. Diermeier TA, Rothrauff BB, Engebretsen L, et al. Treatment after ACL injury: Panther Symposium ACL Treatment Consensus Group. Br J Sports Med 2021; 55:14–22. https://doi.org/10.1136/bjsports-2020-102200.

Ушкодження передньої хрестоподібної зв'язки – якими є тенденції лікування?

Зазірний І.М.[1], Андрєєв А.[2], Коструб О.О.[3], Котюк В.В.[3]
[1]Клінічна лікарня "Феофанія" Державного управління справами, м. Київ
[2]Клініка ортопедії та травматології, Університетська багатопрофільна лікарня активного лікування "Святої Анни", м. Софія, Болгарія
[3]ДУ "Інститут травматології та ортопедії НАМН України", м. Київ

Резюме. *Останнім часом знову збільшується кількість публікацій, які подають результати дослідження щодо відновлення передньої хрестоподібної зв'язки (ПХЗ) як хірургічного лікування для пацієнтів із розривом ПХЗ. Хоча в минулому цей метод часто був неефективним, продовжується впровадження нових підходів для покращення стабільності та біологічної інтеграції в спробі сприяти загоєнню зв'язки та знизити відсоток невдач після відновлення ПХЗ. Еволюція хірургічних методів відновлення ПХЗ привела до покращення короткотермінових результатів спостереження у порівнянні з отриманими раніше даними. Проте ми виявили незначну кількість літературних джерел щодо довгострокових результатів, а масштабних досліджень та порівняння методів відновлення ПХЗ дуже мало. Крім того, не було проведено досліджень високого рівня доказовості щодо відновлення ПХЗ, які можна було б порівняти з отриманими результатами після реконструкції ПХЗ. Прогрес у відновленні ПХЗ дає певну надію, але, наскільки нам відомо, даних, які свідчили б на користь переваги відновлення ПХЗ проти реконструкції ПХЗ, немає, адже останні дослідження показали високий відсоток незадовільних результатів після відновлення ПХЗ. Саме тому реконструкція ПХЗ усе ще має залишатися "золотим стандартом" лікування пацієнтів із функціональними порушеннями після розриву ПХЗ. Якщо наступні дослідження результатів відновлення ПХЗ дадуть стійкі довгострокові результати, які можна буде порівняти з довгостроковими результатами, отриманими після реконструкції ПХЗ, то, можливо, в майбутньому відновлення ПХЗ буде застосовуватися для лікування окремих типів розривів ПХЗ у конкретних пацієнтів.*

Ключові слова: *ПХЗ; передня хрестоподібна зв'язка; травма; лікування; реабілітація.*