The road to recovery: Understanding and managing anterior cruciate ligament injuries in athletes

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ABSTRACT

Introduction: Anterior Cruciate Ligament (ACL) injuries are common among athletes participating in high-demand sports. The ACL is an essential ligament in the knee that provides stability against unwanted movements. The incidence of ACL injuries in the United States is significant, becoming a concern for athletes and sports medicine professionals. This text provides an overview of ACL injuries, including their anatomy, function, risk factors, prevention strategies, and effective rehabilitation techniques. ACL rupture can impact athletic performance and require extensive rehabilitation. Methodology: A literature review was conducted from 2010 to 2022 using the databases PubMed, Scielo, and Medline to provide an updated overview of the relationship between Anterior Cruciate Ligament (ACL) injuries and athletes. Twenty-six articles addressing the clinical, anatomical, pathological, and treatment aspects of ACL injuries in athletes were selected. These articles were published in English, Spanish, or Portuguese. The methodological quality of the articles was evaluated, and the data were qualitatively analyzed, grouping the results by similarity. The data synthesis was presented descriptively, highlighting key information about the clinical, anatomical, pathological, and treatment aspects of ACL injuries in athletes. Discussion: This

work discusses risk factors, prevention, rehabilitation, surgical treatment, psychological impact, long-term consequences, recent research, and specific considerations for female athletes related to Anterior Cruciate Ligament (ACL) injuries. Risk factors for ACL injuries include increased general joint laxity, increased anterior-posterior knee joint laxity, female sex, previous ACL reconstruction, and familial predisposition to ACL injury. The incidence of ACL injuries varies among different sports and sexes. Injury rates are higher in sports such as soccer, basketball, and baseball/softball. Injury prevention strategies are also discussed. Conclusion: Anterior Cruciate Ligament (ACL) injuries are a significant concern for athletes and sports medicine professionals. A comprehensive approach involving prevention, rehabilitation, and safe return to sport is necessary to reduce the risk of ACL injuries in athletes and prevent long-term consequences. Adequate training techniques, injury prevention programs, and effective rehabilitation approaches play a crucial role in minimizing the risk of ACL injuries in athletes. Additionally, physiotherapists play a vital role in the prevention and rehabilitation of these injuries, and it is essential for them to stay updated with the latest research to provide the most effective care to affected athletes.

Keywords: Anterior Cruciate Ligament Injuries, Anterior Cruciate Ligament, Athletic Injuries.

1 INTRODUCTION

Anterior Cruciate Ligament (ACL) injuries are one of the most common types of knee injuries experienced by athletes who participate in high-demand sports such as soccer, football, and basketball. The ACL is a vital ligament that helps support the knee joint, providing stability against anterior tibial translation (TTA) and rotational forces. The annual incidence of ACL injury in the United States alone is approximately 1 in 3,500 people, making it a significant concern for athletes and sports medicine professionals. This essay will provide an overview of ACL injuries, including their anatomy and function, risk factors, prevention strategies, and effective rehabilitation techniques.

The anatomy and function of the ACL are crucial to understanding the impact of ACL injuries on athletes. The ACL is a central ligament located in the knee joint that provides stability against ATT and rotational forces. It is considered the primary passive restraint to the anterior translation of the tibia over the femur. The ACL consists of two bundles, the anteromedial bundle (AMB) and the posterolateral bundle (PLB), which work together to provide stability to the knee joint. An ACL tear or sprain can significantly affect an athlete's ability to perform at their best and may require extensive rehabilitation. [3] [4]

2 METHODOLOGY

A literature review was performed in the Pubmed, Scielo and Medline databases. Articles published in English, Spanish or Portuguese that addressed the clinical, anatomical, pathological and treatment aspects of ACL injuries in athletes were selected. The bibliographic search was conducted between 2010 and 2022, including articles published in English, Spanish or Portuguese. The descriptors used in the search were: "Anterior Cruciate Ligament Injuries" OR "Anterior Cruciate Ligament" OR "Athletic Injuries" AND "Clinical Relevance" OR "Clinical Protocols" OR

"Pathology". Cohort studies, case-control studies and systematic reviews addressing the clinical and physiological aspects of the gut microbiota that is related to human health were included. Studies with samples smaller than 10 individuals, opinion articles, case reports and animal studies were excluded. Initially, 202 articles were selected, of which 85 were excluded because they did not meet the inclusion criteria. After reading the abstracts, a further 91 articles were excluded because they did not present relevant information for the review. Finally, 26 articles were included for the analysis.

The articles were evaluated for methodological quality and the data were analyzed qualitatively, grouping the results by similarity. The synthesis of the data was presented descriptively, highlighting the main information on the clinical, anatomical, pathological and treatment of ACL injuries in athletes. This systematic literature review aims to provide an up-to-date overview of the relationship of Anterior Cruciate Ligament injuries with athletes in general, highlighting the main clinical, anatomical, pathological and treatment strategies available in the scientific literature.

3 DISCUSSION

Several risk factors can increase the likelihood of an athlete suffering an ACL injury. These include increased generalized joint laxity, increased laxity of the AP knee joint (KT-1000), female gender, previous ACL reconstruction, and familial predisposition to ACL injury. Increased generalized joint laxity is a significant risk factor for ACL injury in both men and women, while increased laxity of the AP knee joint is associated with non-contact ACL injuries in women. Female athletes are at a higher risk of suffering ACL injuries than their male counterparts, with studies reporting a two- to ten-fold higher incidence of ACL injuries in female athletes. Finally, previous ACL reconstruction and familial predisposition to ACL injury are also significant risk factors for suffering an ACL injury. [5] [6] [7]

Prevention of ACL injuries in athletes requires a comprehensive approach that includes injury prevention programs, proper training techniques, and use of equipment. Injury prevention programs should focus on improving neuromuscular control and proprioception, strengthening the lower extremities, and correcting biomechanical imbalances. Proper training techniques can help reduce the risk of ACL injuries by emphasizing proper landing mechanics, running technique, and cutting and rotating movements. In addition, the use of proper equipment, such as knee pads, can help reduce the risk of ACL injuries. Finally, effective rehabilitation techniques, such as strengthening exercises, range of motion exercises, and proprioceptive training, can help athletes recover from ACL injuries and prevent further future injuries. [1] [2]

Preventing ACL injuries in athletes is crucial to ensuring their long-term health and athletic performance. Multicomponent preventive training programs have been shown to be effective in reducing the risk of ACL injuries in athletes. These programs usually include instruction and feedback

on the proper exercise technique for at least three of the following exercises: plyometrics, balance and stability, strength training, agility, and speed and flexibility. Neuromuscular training (NMT) injury prevention programs have also been shown to be effective in reducing the risk of ACL injuries. However, there is variation in the design of the program, which can affect its overall effectiveness. It is essential to implement injury prevention programs tailored to an athlete's specific sport and individual needs to reduce the risk of ACL injuries. [8] [9]

Effective rehabilitation approaches are essential for athletes recovering from ACL injuries and preventing further injuries in the future. A criteria-based rehabilitation protocol with an end-result measure was found to be effective in ensuring the safe return of athletes to sport and reducing the risk of reoffending. This rehabilitation approach typically includes strengthening exercises, range-of-motion exercises, and proprioceptive training. It is essential to individualize rehabilitation programs tailored to an athlete's specific needs and sporting requirements to ensure the best results. Prevention of ACL injuries during sport and physical activity can significantly decrease medical costs and long-term disability, highlighting the importance of effective rehabilitation approaches. [10] [8]

Surgical treatment is usually required for athletes with severe or complete ACL injuries to regain knee function and return to sport. ACL reconstruction (CSF) is a common treatment strategy for this injury, as many athletes aim to return to competitive sports. Pre-habilitation before ACLR should include strengthening the quadriceps, improving range of motion, and controlling swelling. Post-surgical rehabilitation should focus on restoring range of motion, regaining strength, and returning to sport-specific movements. Surgery, along with complete rehabilitation and sport-specific exercises, should result in functional stability of the knee joint. Proper post-surgical rehabilitation is crucial to prevent further injuries and ensure the athlete's safe return to sport. [11] [12] [13]

ACL injuries in athletes have not only physical effects, but also psychological impacts that can significantly affect the athlete's well-being. Studies have shown that ACL injuries are associated with anxiety, pain response, mood disorders, depression, and feelings of diminished athletic identity [14]. The psychological impact can also affect an athlete's adherence to rehabilitation programs, potentially leading to suboptimal outcomes. It is important for sports medicine professionals to provide psychological support and appropriate resources to athletes recovering from an ACL injury to promote optimal recovery outcomes.

ACL injuries in athletes can have long-term consequences that can significantly affect an athlete's quality of life. Fear of a new injury and readiness to return to sport are among the most common psychological problems athletes face during ACL recovery [15]. In addition, ACL injuries have been linked to an increased risk of developing osteoarthritis later in life [14]. It is crucial to implement effective preventive strategies and rehabilitation approaches to reduce the risk of long-term consequences of ACL injuries in athletes.

Current research on ACL injury prevention and rehabilitation is focused on developing new and effective strategies to reduce the incidence of ACL injuries in athletes and improve rehabilitation outcomes. Negative psychological responses to injury have been associated with suboptimal adherence and rehabilitation outcomes [16]. ACL reconstruction does not prevent the development of osteoarthritis, but it can improve knee kinematics and reduce secondary injuries to cartilage and meniscus [17]. Recent trends and modalities in ACL rehabilitation research include the use of virtual reality training, wearable technology, and personalized rehabilitation programs [15]. By keeping up to date with the latest research, sports medicine professionals can provide the most effective preventive and rehabilitative care for athletes with ACL injuries.

The incidence of ACL injuries varies between different sports, genders, and types of exposure [18]. In girls, the most frequent sports that result in ACL injuries are soccer (53.2%), basketball (26.5%), softball (11.4%) and volleyball (8%) [18]. In boys, comparable sports such as soccer, basketball, and baseball or softball have similar rates of ACL injury [18]. The differences in injury rates between sports highlight the importance of developing sport-specific injury prevention programs to reduce the risk of ACL injuries in athletes.

Multicomponent preventive training programs have been shown to be effective in reducing the risk of ACL injuries in athletes [8]. These programs should include instruction and feedback on the proper exercise technique for at least three of the following exercises: plyometrics, balance and stability, strength training, agility, and speed and flexibility. Neuromuscular training (NMT) injury prevention programs have also been shown to be effective. However, there is variation in the design of the program, which can affect its overall effectiveness. It is essential to implement injury prevention programs tailored to an athlete's specific sport and individual needs to reduce the risk of ACL injuries.

Female athletes are at higher risk of suffering ACL injuries than their male counterparts, with studies reporting a two to ten times higher incidence of ACL injuries in female athletes [19]. The intrinsic differences between male and female athletes that would explain why women tear the ACL more often than men are still being investigated [20]. However, female athletes are known to break their ACLs at a higher rate in certain sports, including basketball, handball, and soccer [20]. Proper training techniques and injury prevention programs that address the unique biomechanical and neuromuscular factors in female athletes can help reduce the risk of ACL injuries.

Returning to play after an ACL injury and rehabilitation requires careful consideration to ensure the athlete's safety and optimal performance. Guidelines for rehabilitation of upper and lower limb injuries, focusing on specific considerations for female athletes, were presented to assist in the safe return to sport. These guidelines emphasize the importance of addressing neuromuscular control, proprioception, and strength training to reduce the risk of further injury and optimize athletic performance. In addition, the criteria for returning to sport after ACL injury should not be based solely

on functional and patient-reported outcomes, as these may not fully reflect an athlete's readiness to return to sport. A comprehensive assessment, including physical and psychological factors, should be performed to determine an athlete's readiness to return to the game. [21] [22]

Physical therapists play a vital role in the prevention and rehabilitation of ACL injuries in athletes. The goal of rehabilitation is to return the knee to its pre-injury normalized state and achieve tissue homeostasis. Physical therapists work to restore full movement before surgery to reduce the risk of complications. During rehabilitation, they keep the injured knee at rest, improving range of motion and minimizing swelling. The use of RICE and electrotherapy can also help reduce swelling and improve tissue healing. Proper rehabilitation techniques, including strengthening exercises, proprioceptive training, and neuromuscular control, are crucial in preventing further injury and ensuring optimal outcomes. [23] [24]

ACL injuries in athletes can have a significant economic impact on players and teams. Recovery costs (COR) and potential loss of revenue due to lost games can have long-term financial consequences. Studies have shown that ACL tears in NBA players result in significant recovery costs, including medical expenses and lost productivity. In addition, the loss of income due to lost games can have a significant impact on an athlete's financial stability. These economic impacts highlight the importance of implementing effective prevention and rehabilitation strategies to reduce the incidence of ACL injuries in athletes. [25] [26]

4 CONCLUSION

In conclusion, ACL injuries are a significant concern for athletes and sports medicine professionals. A comprehensive approach to prevention, rehabilitation and safe return to sport is needed to reduce the risk of ACL injuries in athletes and prevent long-term consequences. Proper training techniques, injury prevention programs, and effective rehabilitation approaches are crucial to minimizing an athlete's risk of suffering an ACL injury. In addition, physical therapists play a vital role in the prevention and rehabilitation of ACL injuries in athletes. By keeping up to date with the latest research, sports medicine professionals can provide the most effective preventive and rehabilitative care for athletes with ACL injuries.

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