

The Incidence and Rate of Return to Competitive Sport Post ACL Reconstruction: Literature Review

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Abstract

ACL injuries are common in competitive team-ball athletes and are frequently career ending or compromising. The rate of return to competitive sport after ACL injury/management is debatable as well as the surgical and rehabilitation factors that should be considered while managing ACL injuries in order to optimize the return of the athlete to competition. The aim of this research was to investigate the incidence and the rate of return to competitive sport after ACL injury and to explore the various factors which need to be considered in ACL surgery and rehabilitation to support the process of successful return to competitive play. Research aims were met through extensive review of relevant ACL management literature. The rate of return to competitive sport averages around half of the athletes operated for ACL injury with a high rate of re-injuries especially within the first six months after surgery. Proper tunneling technique is an important surgical factor in relation to return to sport and surgery should be done as early as the knee is fully extended addressing all the concomitant injuries. Rehabilitation should be individualized, gradual and comprehensive, covering all the biopsychosocial aspects of the athlete. Decisions of when and how to return to sport are complex and should be team-based and preferably whole- model-based. The rate of return to competitive sport after ACL injury management is relatively low and not as commonly used to be thought of. Many factors are to be considered to optimize the return to competitive sport after ACL injury management.

Keywords: ACL injuries; Return to competitive sport; Team-ball athletes

1. Introduction

Although the general expectations of safe and full return to sport after having ACL reconstruction surgery are relatively high, the incidence of return to competitive sports after ACL injury in the literature is debatable. Some of the studies state a satisfactory percentage of athletes to be successfully returning to competition (up to 96% in some reports). On the other hand, some studies proved that the true incidence of return to competitive sport is only around the half of the players or a little more. The ACL injury is one of the most heavily researched topics in the orthopedic in spite of that still there is a paucity of information regarding rate of participation in competitions, length of career and level of performance. The aim of this article is to review the incidence of return to full competitive sports after being exposed to ACL injury, and to summarize the factors that need to be considered in ACL surgery and rehabilitation which would affect successful return to competitive play and support its decision-making process.

2. Incidence and rate of return to competitive sport

The rate of return to competitive level of play after surgical management of Anterior Cruciate ligament (ACL) reconstruction in the literature varies between studies. In a more recent study, Ganesh Balendra et al. conducted a retrospective review of a consecutive series of all primary ACL-R undertaken by the senior author [232 knees in 215 professional footballers (17 bilateral)] between 2005 and 2018. The rate of return to play in this study was 96.1%, with 90.1% at the same level or higher, at a mean 10.5 months. Also, a case control study by Erickson et al. (2013) on ACL injured soccer players in the Major Soccer league from 1996-2012, comparing with matched controls, the authors found that 77% of the players who had ACL injury returned to competitive sports and that most of them returned within the 1st year after the injury. They also found that neither performance nor survival in the Major Soccer League significantly affected between players and controls. On the other side Ardern et al. (2011) found in their systematic review, after critically reviewing 48 studies including more than 5700 patients, that the rate of return to pre-injury level was 63% and the rate of return to competitive sports was only 44% Ardern et al. (2011). Three years later, the same authors, Ardern et al. (2014a), did another large-scale study, in the form of a systematic review of 69 articles which included more than 7500 participants, aiming at investigating the rate of return to competitive sport and the other contextual factors which may have a role in the return to sport process. They reported that only 55% of athletes returned to competitive sport level after surgery and that the rate of return to any type of sports, not being competitive, constitutes two thirds of the total number of patients. The same percentage of 55% return to competitive sport was also found by Failla in his study from Norway, published in 2015 Failla et al. (2015). Another recent publication by Senorski et al. (2018) found a very close percentage of patients to the study of Ardern being back to strenuous knee sports activity in the 1st year that is 57%. Shah et al. (2010) did a case series on players of the National Football League returning to competitive sports after ACL surgery and concluded that the rate of return to sports is lower than might have been thought and that the more experienced players in the National Football League are more likely to return. As shown in the above studies, there is a discrepancy between the results and these due to one factor that could result in vastly different results and views regarding successful general return to play is sample size. The studies which reported a lower rate of return to competitive sports after ACL surgery were plenty and critically more robust regarding sample size and study designs.

3. Rate of regular participation in competitive sport after ACL surgery

Considering the successful longer-term return to sport and regular participation in competitive sport has been a point of discussion in the literature. Athletes may return to competitive sport within the first year after surgery but do not regularly participate in competitions afterwards. It was found that studies with a mean follow up time of more than 2 years report a lower rate of return to competitive sports in comparison to studies with a mean follow up time of less than 2 years denoting that there may be a decline in sports participation after the 1st year of return Ardern et al. (2011). Many studies have pointed out the difference between return to sport within the 1st year and the sustained regular sporting activity at a competitive level after the 1st year from surgery. From these studies, the study done by Walden on 4443 football athletes from 78 clubs sharing the highest national league in 16 European countries, over a period extending from 2001-2015. Although the rate of return to sport after ACL reconstruction within the 1st year after surgery in this study was remarkably high, above 90%, those who could continue playing at the same competitive level after 3 years were only 65% Walden et al. (2016). Brophy et al. (2012) did a cohort study specifically on Soccer players and found that they have a good initial return to competitive play, especially among younger age and male athletes, but participation declines over time.

4. Length of competitive sports' career after ACL surgery

Arundale et al. (2018) examined the career length of players in a major soccer league through following forty ACL injured players who had ACL surgery after their return to competitive level to forty age-matched controls. The authors found that career length is significantly shorter after ACL reconstruction. Twelve players only out of forty in the ACL injured group had the same expected career length in comparison to their controls. Three fourths of athletes (74%) in this study could return to their soccer team at the level of major soccer league, but they lost nearly half of their expected length of career in comparison to their counterparts with no ACL injury.

Another study by Read et al. (2017) showed that 61% of operated athletes had successfully returned for at least half a season. However, those who returned showed in the same time a relative earlier retirement from the field in comparison to their counterparts. Only 26% stayed active in the National Football League after three years from surgery. Another study by Mai et al. (2016) also demonstrated a significantly shorter career after ACL reconstruction among National Football League players if compared to other common bony orthopaedic procedures as intramedullary nailing.

5. Performance-based outcomes after ACL surgery

Commenting mainly on performance, Read et al. (2017), found significant change from above average to average performance among ACL operated athletes when compared to matched controls.

Mohtadi and Chan (2017) did a systematic review to investigate the effect of ACL surgery on athletes' performance after return to sports. In this review, fifteen articles were included, all of them studied the performance outcome after ACL surgery on competitive level athletes representing many team-ball sports like football, basketball and soccer. All the included articles studied variables which determine the outcome of ACL operated competitive athletes, more than just simple return to sports like longevity of career, rankings, goals, assists, participation time and medals. The authors found a low to high risk of bias in the included articles, however, they could conclude that, in general, there was a decrease in the level of performance after return of ACL operated athletes to competition which was variable according to the type of sport practised.

As shown in the above discussed studies, the overall results regarding return of ACL injured patients to competitive sports level indicate a general initial high rate within the first year with a subsequent decline within the next three-five years accompanied with a higher rate of re-injuries, questionable performance and a relatively shorter career. These results illustrate the discrepancy between the general expectation after ACL injury management and reality when based by literature scientific evidence (Ellman 2015).

6. Re-operation and re-injury rates

Re-operation and re-injury rates were reported in some studies to be very high after return to competition Brophy et al. (2012). Kamath found high re-injury rate after recovery from ACL surgery and return to sports and found also that the younger the player having the injury and surgery, the higher is the rate of re-injury Kamath et al. (2014). This high re-injury rate, however, did not mean a low rate of return to play within the 1st six to twelve months postoperatively, as return to play during this early period is high as reported by many authors, but it questions the overall success of ACL injury management among competitive athletes, for this reported high re- injury rate Walden et al. (2016).

Some studies also commented on the quality of ACL management and the rate of return to sports after ACL surgery through investigating the incidence of re-injury of the ACL after initial return to sports. Paterno in 2013 found a 6-fold rise in the incidence of having a second ACL injury within the first two years after clearing the athlete to be back to sports. This means that the rate of return to sports may be overestimated in the short-term follow up studies following athletes for 6-12 months, as some of those athletes could have had another ACL injury some time later Paterno et al. (2013).

A significant negative impact of ACL surgery on the longer term was also recently reported by Niederer et al. (2018). Although the initial rate of return to sports in this study was high, the athletes who succeeded to stay engaged to football after 5 years were 69% and only 41% of them stayed at the same professional level. Injury to the contralateral ACL was also recognized in the literature reaching a figure of 20% higher risk in comparison to non-injured athletes Kyritsis et al. (2016).

The systematic review by Wiggins et al specifically concerned young competitive athletes. This study demonstrated a very high incidence of a second ACL injury sometime at the athlete's later competitive sports' career, reaching up to 25% or equating to 30-40 times greater risk if compared to non-injured adolescents. The study pointed out also that this incidence is highest in the early period following clearance for return to sports Wiggins et al. (2016).

7. Predictive factors of successful return to sport after ACL injury

Arden et al (2016) collected some of the factors which was evidenced to be of predictive value in the successful process of return to sport after ACL injury. These factors included younger age groups, absence of other concomitant chondral or meniscal injuries, being a professional athlete, psychological readiness, high knee functional symmetry as well as close follow up and high- quality sports' physiotherapy. The same factors achieved by Ganesh Balendra et.al study which report a reduction in RTS rates in patients are age 25 years or older, or has meniscus injuries that requiring surgery at the time of ACL-R and those undergoing a subsequent operation prior to RTS.

8. Influence of surgical details and Rehabilitation on return to competitive sport

Surgical ACL reconstruction is the usual way of treatment of acute ACL rupture in competitive athletes who wish to return to competitive career. Before surgery, physiotherapy should have a role, as achieving full knee extension is critical, as well as regaining normal walking pattern. Preoperative counselling and supporting the athlete psychologically is important. There is no hard evidence to support the usual trend to delay surgery till the third or the fourth week after the injury as most surgeons used to do. Early surgery avoids unnecessary waiting and saves the athlete's time which can be invaluable to his career. Regarding the technical operative factors, tunnel position of the ACL graft was found to be important in providing the best possible ACL graft function and preparing the knee for return to pivoting sports. The most isometric point of the anatomic area of the native ACL attachment has been currently agreed by most of the authors to be the best location for ACL graft tunneling. Grafting the ruptured ACL is another critical point in achieving satisfactory results after performing ACL surgery for competitive athletes. Both BTB and HT auto-grafts are commonly used in competitive athletes with comparable results as regard return to sport. BTB graft, however, is more recommended for team-ball competitive athletes for its advantages of fast bone-bone healing, being stiffer than HT and because it keeps the hamstrings strength which is needed for such a kind of athlete. It should be kept in mind however, that BTB grafts are associated with a higher graft site morbidity and a higher incidence of anterior knee pain. Quadriceps tendon auto-graft is currently more and more used with considerably good results while allografts do not show in the literature the same rate of return to sport as autografts generally have. Synthetic grafts on the contrary are not the best grafts for competitive athletes regarding durability and safety and are kept for the rare cases where autografts cannot be used or not any more available like in multiple revision surgeries.

Graft tensioning is another point that should be considered while doing surgery for a competitive athlete. Whatever the type of the graft used, appropriate tensioning should be applied to it, avoiding too tight or too loose grafts with their potential deleterious consequences on the knee function. Associated ligament, chondral or meniscal injuries should be addressed as well as the need for extra-articular augmentation like iliotibial tenodesis or antero-lateral ligament reconstruction in the higher degrees of instability or in chronic cases. Antero-lateral ligament reconstruction in conjunction with ACL reconstruction done in competitive athletes was recently evidenced to have better results in relation to return to sport.

Rehabilitation after ACL surgery is a key factor in the process of successful return to competitive sport. It should start as soon as the diagnosis of ACL injury is made and extends until the athlete is cleared and allowed to compete. Unfortunately, there is no consensus in the literature about a well-recognised protocol for competitive athletes. Most of the designated programs in the literature are divided into three or four phases. The first phase focusses on relieving pain and swelling and keeping the range especially keeping full knee extension. The second phase focusses on regaining muscular strength of the whole lower limb especially the quadriceps and hamstrings and starting neuro-muscular rehabilitation. This is done while promoting the range of knee motion and checking the gait pattern. The third phase focusses on balance, proprioception, agility and neuromuscular exercises together with promoting the muscular strength and running pattern and correcting proximal muscular deficits (around the hip). Afterwards, and upon passing the incremental battery of testing of each phase the athlete can progress to speed and resistance exercises, arthrokinetic preventative exercises and sports' specific exercises. There are no differences in the literature between the results of the accelerated and non-accelerated programs, it is recommended that programs are to be individualised for each athlete according to his/her medical as well as bio psychosocial circumstances.

9. Return to sports decisions

Decisions of return to competitive sport are complex and multifactorial and better taken through a team work. Criteria upon which a decision of return to competitive sport are not universal and no consensus about when or how an athlete can return safely to compete. Many criteria were postulated in the literature to help guide the process of return to sport with variable validity. Time passing since surgery is a well evidenced criterion to consider upon taking decisions of return to sport. It was found that return before having nine months passed since surgery is associated with a higher incidence of re-injury. Beside time, many other subjective and objective criteria have been reported in the literature to base the decision of return to sport like clinical assessment, muscular lower limb function and patient reported outcomes with variable validity.

There is more than one comprehensive model of return to sport introduced recently in the literature. Universally accepted models include: The optimal loading model, the biopsychosocial model and the strategic assessment of risk and risk tolerance model (StARRT) by Shreir (2015). StARRT model is widely accepted by many authors and constitute a formulated course of action to properly base the decisions of return to sport after ACL injury. Time since surgery as a separate criterion in combination with other subjective and objective criteria are to be all utilised to take the decision of return to competition as appropriate and as safe as possible. Among the various return to play models available, the strategic assessment of risk and risk tolerance model (StARRT) is the most acceptable and best applicable.

10. Conclusion

The rate of return to competitive sport after ACL injury is relatively low, averaging half of the injured athletes. To achieve the best results, surgery should be performed as early as the knee is fully extended with the proper tunneling and grafting techniques, preferably using BTB graft and addressing all the concomitant injuries. The rehabilitation role is critical and should be gradual and balanced. Decisions of when and how to return to competition are complex and should be team-based preferably through the strategic assessment of risk and risk tolerance model.

Conflicts of interest

The author has no conflict of interests.

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