to the knee (11.0%) and unspecified or otherwise poor knee function (10.2%). Among knee related reasons for failure to return, the most frequently cited included unspecified knee problems/poor function (28.4%), pain (24.3%), and weakness (11.9%). Evidence for potential publication bias and study heterogeneity was present. Conclusion: Multiple systematic reviews and meta-analyses have reported in detail the rate of return to sport after ACL reconstruction. However, the data reported in these studies often fails to provide insight as to the specific reasons for why an athlete fails to return to sport after this procedure. This study aims to address this gap in literature and provide the specific reasons for why an athlete fails to return to sport after ACL reconstruction. This study estimates the rate of failure to return to sports after ACL reconstruction to be 25.5%, with one-third of athletes citing fear of reinjury as the major deterrent for returning to sports. We highlight how factors independent of direct surgical outcomes may impact an athlete’s ability to return to play given that the predominant reason for not returning to sport after ACL reconstruction was unrelated to the knee.

Category: Knee - ACL

Rates and Levels Of Elite Sport Participation at 5 Years After Revision ACL Reconstruction

Abstract ID# 22370
All Authors: Vitór Hugo Pinheiro MD, MSc PORTUGAL
Mary Jones MSc Grad Dip Phys UNITED KINGDOM
Kyle Borge MD UNITED STATES
Ganesh Balendra MBBS AUSTRALIA
Nathan P. White B Physio, MBBS, FRACS, FAOrthA AUSTRALIA
Simon Ball MA, FRCS(TrkOrth) UNITED KINGDOM
Andy Williams MBBS, FRCS(Orth), FFSEM(UK) UNITED KINGDOM

Summary:
Elite athletes achieved high initial RTP rates after revision ACL-R with the majority returning to pre-operative levels of competition; however, significant decreases in RTP level were noted at 2 and 5 years post-operatively.

Data:
Introduction The aim of this study was to determine the rate of return to play (RTP) and competition levels at 2 and 5 years post revision ACL-R in elite / professional athletes. The secondary objectives were to assess the association between meniscus and chondral pathologies at the time of revision surgery on RTP and competition level. Methodology A retrospective review of a consecutive series of all revision ACL-R undertaken by the senior author between 2009 and 2019 was carried out. Patients were included if they were elite athletes aged 17 years or older who underwent revision ACL-R a minimum of 2 years previously. Cases of combined-ligament injury and cases which required high tibial osteotomy (HTO), either concurrently or previously were excluded. Outcome measures used were RTP rates, time to return to play and competition level. Statistical Analysis Chi square or Fisher’s exact tests were used to determine whether RTP rates and competition level differed or not with age, sport, having a medial or lateral meniscus lesion and the presence and extent of chondral damage at revision ACL surgery. Kaplan–Meier curves were generated to illustrate RTP rates and maintenance of pre-injury competition levels survival at 2 and 5 years after revision ACL-R. Results Forty-nine knees in 48 elite athletes met the inclusion criteria. After revision ACL-R 43 (87.8%) elite athletes achieved RTP, of which 75.5% were at the same level. At 2 years post-surgery, 39 (79.6%) were still playing, 25 (51%) at the same level; and at 5 years post-surgery 20 (44.4%) were still playing, 9 (20%) at the same level. Elite athletes with < 50% thickness or no articular cartilage lesions were more likely to RTP (94.6% versus 66.7%, p = 0.026), as well as maintain the same competition level (83.8% versus 50%, p = 0.047) compared to those with > 50% thickness chondral lesions. Those without medial meniscus pathology were more likely to RTP at the same level after revision surgery (94.4% versus 64.5%, p = 0.036). The median time elite athletes continued to play after revision ACL-R was 73 months (61y1m) (95% CI, 43.4 to 102.6), 23 months at the same level (95% CI, 13.6 to 32.4). The probability of still playing at 5 years post-surgery was 55.9% with 22.5% chance of maintaining pre-injury competition level. Conclusion In elite athletes, RTP rates and competition level decreased over time after revision ACL-R. The presence of > 50% thickness chondral pathology was associated with lower RTP rates and competition level at RTP time, while medial meniscus pathology was associated with lower competition level at RTP.

Category: Knee - ACL

The Impact of Covid-19’s Social Isolation Policies on Functional Outcomes after Anterior Cruciate Ligament Reconstruction: A Retrospective Cohort Study

Abstract ID# 23141
All Authors: Quinn Steiner BS UNITED STATES
Anthony Zachariats MD UNITED STATES
Elizabeth Chumanov DPT UNITED STATES
Geoff S Baer MD UNITED STATES
Brian E Walczak DO, PhD UNITED STATES

Summary:
COVID-19 related policy measures were associated with lower quadriceps strength and a lower probability of achieving the threshold for returning to sport-related functional activities after ACLR.

Data:
Introduction The coronavirus 2019 (COVID-19) pandemic resulted in policies that limited access to health care resources, including rehabilitation services following elective surgery. This study aimed to assess the impact of these COVID-19 measures on functional outcomes after anterior cruciate ligament reconstruction (ACLR). Methods Our institution shut down all in-person services in March 2020. Patients who underwent ACLR within the previous nine months (6/11/2019–3/11/2020) were defined as having their rehabilitation interrupted due to COVID-19 (COVID-I). Patients with ACLR done the year prior (6/11/2018–3/11/2019) were the comparative cohort. Multi-ligament reconstruction, physical sparing ACLR, and lack of 1-year follow-up excluded patients. Dependent functional outcomes included: isokinetic quadriceps testing at 60 deg/sec and 240 deg/sec, vertical 4-hop, horizontal hop, and 4-cross-over hop distances. A linear mixed-effects regression model was used to estimate group differences for isokinetic quadriceps testing. A reverse Kaplan-Meier analysis assessed the probability of achieving > 90% limb symmetry index (LSI) for all functional outcomes and isokinetic quadriceps strength at 60 deg/sec at 1-year postoperative. Results A total of 176 patients, 80 Non-COVID patients and 96 COVID-I patients, were included. Twenty-nine patients (16.4%) were excluded. Baseline characteristics were similar between groups. The rate of achieving > 90% LSI for all functional tests at 1-year postoperative was significantly less for COVID-I patients. Similarly, the rate of achieving an isokinetic strength at 60 deg/sec of > 90% LSI at 1-year postoperative was significantly less for COVID-I patients. Controlling for postoperative time, sex, BMI, and age, patients in the Non-COVID group had a 2.96% (95% CI: -1.66 to 7.60) greater isokinetic quadriceps strength LSI at 60 deg/sec compared to the COVID-I group (p-value = 0.215). Similarly, patients in the Non-COVID group had a 4.69% (95%CI: 1.08 to 8.31) greater isokinetic quadriceps strength LSI at 240 deg/sec compared to the COVID-I group (p-value = 0.013). Conclusion COVID-19 related policy measures were associated with lower quadriceps strength and a lower probability of achieving the threshold for returning to sport-related functional activities after ACLR.

Category: Knee - ACL

Nationwide Incidence of ACL-R in Professional Athletes in Sweden

Abstract ID# 21425
All Authors: Daniel Castellanos MD SWEDEN
Anders Stalman MD, PhD, associate professor SWEDEN
Joanna Kvist Professor, RPT SWEDEN
Henrik Hedevik MSc SWEDEN
Per Wretenberg MD,PhD, Prof. SWEDEN

Summary:
The incidence rate of ACL-R per 1000 athlete events is 2 to 5 times higher in male professional athletes compared to male professional athletes in Sweden.

Data:
Introduction Few studies have looked at the nationwide incidence rate (IR) of anterior cruciate ligament reconstruction (ACLR) in higher level athletes in different sports simultaneously. To better understand the nature of ACL-R within different sports in Sweden, we aimed to study the IR of ACL-R in high-performance athletes in the six of the most common sports in the Swedish National Knee Ligament Registry (SNKLR) : soccer, ice hockey, basketball, handball, floorball, and alpine sports. Methods Patient data from the SNKLR, between January 2005 and December 2020, was linked to team rosters and event data of the two highest divisions of soccer, ice hockey, basketball, handball, floorball,
and the highest levels of alpine sports. The data was later linked to the database from the main Swedish insurance company of injuries for organized licensed and elite athletes, for additional injury information in future studies. Professional athletes, 15–40 years of age, who sustained an anterior cruciate ligament (ACL) injury and later underwent ACL-R during seasons 2005–2020 while playing in the two highest divisions in team sports or participating in official International Ski and Snowboard Federations were included. Outcomes were evaluated based on athletes sex, age, and division. The IR of ACL-R was calculated as injuries per 1000 athlete events (AE) and as injuries per 100000 athlete-seasons. Results Preliminary results identified a total of 1014 ACL-R in 932 athletes during the study period. Female basketball athletes had 5.6 times higher IR of ACL-R than male basketball athletes (IR 1.238 vs 0.221 per 1000 AE, incidence rate ratio (IRR) 5.595, 95% CI 3.370–9.289, p < 0.001). In soccer, handball, floorball, and alpine sports the IR of ACL-R per 1000 AE was 2 to 3 times higher for females than males. Professional ice hockey however, there was no significant difference in the IR of ACL-R between females and males (IR 0.080 vs 0.081 per 1000 AE, IRR 0.982, 95% CI 0.388–2.485, p = 0.844). The IR of ACL-R per 1000 AE in soccer was significantly higher compared to floorball, ice hockey, and alpine sports in both females and males. There was a significant higher IR of ACL-R in female handball athletes compared to female soccer athletes (IR 1.705 vs 1.161 per 1000 AE, IRR 1.469, 95% CI 1.163–1.857, p < 0.001). Conclusion This is the first nationwide study looking at the total IR of ACL-R in six different knee-strenuous sports during a same study period. The IR of ACL-R per 1000 AE in handball, soccer, basketball, floorball, and alpine sports were significantly higher in female athletes compared to male athletes. However, there was no significant difference in IR of ACL-R per 1000 AE in elite ice hockey between females and males. It seems necessary to continue to study and understand the IR of ACL-R in different sports to improve preventive measures for ACL injuries in the right sports and in the right individuals.

Category: Knee - ACL

Lateral Meniscus Extrusion on Magnetic Resonance Imaging of Anterior Cruciate Ligament Injury is Likely Complicated by Lateral Meniscal Posterior Root Tears

Abstract ID# 21861
All Authors: Yusuke Yanatori MD JAPAN
Junsuke Nakase MD, PhD JAPAN
Rikuto Yoshimizu JAPAN
Mitsuhiro Kimura JAPAN
Tomoyuki Kanayama MD JAPAN
Hiroiyou Tsuchiya JAPAN

Summary: If preoperative magnetic resonance imaging of anterior cruciate ligament injury reveals lateral meniscus extrusion (LME) over 2.2 mm, there is a high possibility of complete lateral meniscus posterior root tear (LMPRT) complications. This LME cut-off value had a sensitivity of 78% and specificity of 71% for complete LMPRT.

Data: Background Lateral meniscus posterior root tears (LMPRTs) have been identified as a combined injury with anterior cruciate ligament (ACL) rupture in 6.7–20.4% of patients in previous studies. Because LMPRT is associated with meniscal extrusion and rotational instability and has been linked to degenerative changes in the knee, complete LMPRT repair is recommended. However, it is difficult to diagnose complete LMPRT based on magnetic resonance imaging (MRI) findings alone. In addition, even with an intact meniscal root, various degrees of LM extrusion (LME) are usually observed in association with ACL tears. Therefore, LME has not been demonstrated as an indicator of LMPRT. Objectives The purpose of this study was to investigate the relationship between preoperative LME, provide an arthroscopic evaluation of LMPRT in ACL-injured knees, and determine the complete LMPRT cut-off value from preoperative LME.

We hypothesized that preoperative LMEs would be larger in patients with complete LMPRTs associated with ACL injuries than those with partial LMPRTs with ACL deficiency. Study Design & Methods Four hundred four patients who underwent ACL reconstruction at our hospital between February 2011 and July 2021 were retrospectively evaluated. A total of 45 patients were included in the study, 35 with LMPRTs with concomitant ACL injuries and 10 with intact lateral menisci with ACL injuries. The most widely used classification of La Prade divides the LMPRTs into five types. Using this classification, 35 patients were divided into two groups, partial (type 1) and complete (types 2–5) LMPRTs, based on arthroscopic findings at the time of ACL reconstruction. LME was measured using MRI as the distance from the lateral edge of the tibial plateau cartilage to the outer border of the LM. Results A total of 35 LMPRTs were classified using the morphological classification system; 17 knees (10 males and 7 females; mean ± SD age 23.5 ± 11.6 years) were classified into the partial LMPRT group and 18 (9 males and 9 females; mean ± SD age 20.4 ± 6.7 years) into the complete LMPRT group. Patients in the complete LMPRT group had 3 radial tears (type 2), 11 bucket-handle tears (type 3), and 4 oblique tears (type 4). There were no cases of avulsion fractures (Type 5). 20 knees (10 males and 10 females; mean ± SD age 20.7 ± 2.7 years) were classified into the intact lateral meniscus group. There were no significant differences between the three groups in terms of the relevant characteristics of the participants. On MRI evaluations, preoperative LMEs were larger in complete LMPRTs associated with ACL injuries than that in intact lateral menisci with ACL injuries and partial LMPRTs with ACL injuries. The ROC analysis identified the optimal cut-off point of the preoperative LME as 2.2 mm, which had a sensitivity of 78% and specificity of 71% for complete LMPRT. Conclusion When a preoperative MRI of ACL injury reveals LME over 2.2 mm, there is a high possibility of complete LMPRT complications.

Category: Knee - ACL

Delayed ACL Reconstruction Increases the Incidence of Concurrent Intra-Articular Pathology In Adolescent Patients

Abstract ID# 21896
All Authors: Todd Phillips MD UNITED STATES
Tucker Cushing MD UNITED STATES
Zachary Terner PhD UNITED STATES
Neal Goldenberg MD UNITED STATES
Theodore B. Shybut MD UNITED STATES

Summary: Skeletally mature patients with surgery >12 weeks from injury are at the highest risk for chondral and meniscal medial injuries in delayed ACL reconstruction. Data: Abstract: Introduction: Knee injuries, specifically anterior cruciate ligament (ACL) injuries, are becoming increasingly more common in the young athlete. Recent literature has highlighted the association of intra-articular pathology, specifically the menisci and articular cartilage, within ACL-deficient knees. Time-to-surgery has been shown to significantly affect the rates of concurrent injuries at the time of ACL reconstruction after 6 months; however, this has not been well studied in the transitional adolescent population with the addition of skeletal maturity as a risk factor Purpose: To evaluate if delays in ACL reconstruction (ACLR) impact the observed incidence of concomitant meniscal and chondral injuries in an adolescent cohort and to identify and recommend a surgical timeframe after which concurrent injuries significantly worsen. Study Design: Retrospective Cohort Method: Included subjects were aged 21 and below and underwent primary ACLR within 6 months of injury between January 2012 and April 2020. Skeletal maturity was determined via radiographs. Laterality, location, and severity/pattern of meniscal and chondral injuries were recorded. Multivariate logistic regression was utilized to identify risk factors for intra-articular pathology. Cut-off analysis was added to regression models to identify trends of concurrent injuries. Results: 850 patients met inclusion criteria. Patients with observed articular cartilage injuries had a significantly increased average time to surgery of 66 days (p=0.008), while medial meniscal injuries trended towards significance (p=0.09). Survival analysis portrayed a significant degradation rate between patients with and without chondral injuries (p=0.01). Multivariate regression analysis indicated that chondral injuries were predicted by time to surgery (OR 1.01, 95%CI [1.00,1.01], p=0.009) and skeletally mature patients (OR 0.00, 95%CI [0.00,0.007], p=0.014). Cut-off analysis showed that after 8 weeks the proportion of patients with observed chondral injury that had not undergone surgery increased with time, and that patients with surgery >12 weeks had significantly higher risk of intra-articular injury compared to acute fixation (<6 weeks). Medial meniscal injuries were prognosticated by time-to-surgery (OR 1.52, 95%CI [1.05,2.18], p=0.025), skeletally mature patients (OR 0.00, 95%CI [0.00,0.20], p=0.009), Age*Skeletal Maturity (OR 1.55, 95%CI [1.16,2.13], p=0.004), and Sex*Skeletal Maturity (OR 0.20, 95%CI [0.08,0.51], p<0.001). Time-to-surgery was not a risk factor for lateral meniscal tears. Conclusion: Skeletally mature patients with delays in ACL reconstruction greater than 12