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

Abstract ID# 21861
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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
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Summary: Skeletally mature patients with surgery >12 weeks from injury are at the highest risk for chondral and medial meniscal 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 11 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, 0.07], 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 = 0.014) and skeletal maturity (p < 0.008). 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 weeks had a significantly increased risk for chondral and meniscal injuries.
weeks are at significantly increased rate of observed concurrent chondral and medial meniscal injuries. While time to surgery significantly correlated with rates of observed concurrent pathology, after approximately 8 weeks, the rates of articular chondral injury increase proportionately with time from injury in both the skeletally mature and skeletally immature populations.

Category: Knee - ACL

Patients with Bilateral ACL Reconstruction (ACLR) Have 3x the Rate of Posterior Tibial Slope Greater than 12-Degrees Compared to Unilateral ACLR: MRI and Radiographic Evaluation

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Summary:
The purpose of this study is to compare PTS angles measured on x-ray and MRI between patients who had bilateral ACL tears compared to those who had only sustained a unilateral ACL tear.

Data:
Purpose: Increased posterior tibial slope (PTS) is a risk factor for primary anterior cruciate ligament (ACL) tear, as well as subsequent ACL graft tear. Prior literature has shown conflicting relationships between an increased PTS and bilateral ACL tears. We aimed to compare PTS angles, as well as the rate of markedly increased PTS (>12° on lateral radiograph; >7° on MRI), between patients who underwent bilateral ACL reconstruction (ACLR) vs unilateral ACLR. A secondary purpose was to examine whether these associations remained consistent on both plain radiographs and MRIs.

Methods: We retrospectively identified patients who underwent primary ACLR at our institution from the years 2012 to 2020. Patients with non-simultaneous bilateral ACLR (n=53) were matched to those with unilateral ACLR (n=53) by age, sex, and BMI. Exclusion criteria were: rotated lateral radiographs, inadequate quality MRI, concomitant ligament injury or fracture. Unilateral ACLRs with less than 5-year follow-up or revision were further excluded. Three blinded readers measured PTS on lateral radiographs, while mediolateral (MPTS) and lateral (LPTS) were measured on MRI. Bivariate regression was performed to determine correlation between radiograph and MRI measurements. Results: PTS in the bilateral ACLR cohort was significantly greater than the unilateral ACLR cohort on radiographs (11.26° vs 10.13°, p=0.044) and LPTS (7.32° vs 6.08°, p=0.012), but not MPTS (4.55° vs 4.17°, p=0.467). The percentage of bilateral patients with radiograph PTS >12° was 41.0%, compared to 13.2% in unilateral cohort (p=0.012). The bilateral cohort had a significantly greater rate of LPTS >7° compared to unilateral patients (53.8% vs 32.1%, p=0.016), but not MPTS (p=0.467). On MRI, LPTS (5.93° ± 3.20°) was significantly greater than MPTS (5.12° ± 2.78°, p<0.001). There was weak correlation between MPTS-radiograph (R=0.24, p=0.02) and LPTS-radiograph was not significantly correlated (R=0.03, p=0.810). Conclusion: Patients who underwent bilateral ACLR had significantly greater PTS on radiographs and LPTS on MRI compared to those with unilateral ACLR. The rate of PTS >12° was 3.1x greater among bilateral ACLR compared to unilateral ACLR. PTS measurements on radiographs demonstrated weak-to-negligible correlation with MRI measurements, suggesting future normative PTS values should be reported specific to the imaging modality.

Category: Knee - ACL

The Covid 19-Related Lockdown Increased The Rate of Cyclops Syndrome After ACL Reconstruction for Patients With Unexpected Home-based Self-Guided Rehabilitation

Abstract ID# 21374
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Summary:
Exceptional measures related to the COVID-19 led to the stop of rehabilitation with physiotherapist after ACLR changing the postoperative social habits and leading to self-guided rehabilitation with a significant increase of the rate of cyclops syndrome.

Data:
Introduction After Anterior Cruciate Ligament Reconstruction (ACLR), complete extension should be recovered before the 6th week otherwise the risk of cyclops syndrome is significantly increased. The COVID 19 pandemic has led to a lockdown and to the absence of supervised rehabilitation with physiotherapist for several weeks, requiring self-made rehabilitation for patients operated just before this lockdown. The hypothesis was that the rate of cyclops syndrome increased during the lockdown with self-guided rehabilitation with a significant increase of the anterior arthrosis rate. Methods A COVID series cohort of 72 patients operated with hamstrings graft for ACLR between February 10 and March 16, 2020 had a part of the rehabilitation of the first 6 postoperative weeks done during the lockdown with videos on a dedicated website. A clinical examination was performed at a minimum follow-up of 1 year with analysis of the range of motion, IKDC, Lysholm, Tegner and ACL-RSI scores. This series was compared to a matched-paired control cohort of 72 patients operated in 2019 with a complete classical postoperative supervised-rehabilitation with a physiotherapist. Results In the COVID series, mean follow-up was 14.5 months, rate of second surgery for clinical cyclops syndrome was 11.1% (8 patients). The rate was 1.4% in the control series with a statistical difference (p=0.01). In the COVID series, anterior arthrosis was done with a mean delay of 8.6 months after the primary surgery, four patients had another surgery (3 for meniscal procedure, one for device removal). Mean Lysholm was 86.6 ± 14.1 (range, 38-100); Tegner was 5.6 ± 2.3 (range 1-10); Subjective IKDC was 80.3 ± 14.7 (range 33-100) and RSI-scale was 77.3 ± 19.4 (range 33-100) in the COVID series. Conclusion Exceptional measures related to the COVID-19 led to the stop of rehabilitation with physiotherapist after ACLR changing the postoperative social habits and leading to self-guided rehabilitation with a significant increase of the rate of cyclops syndrome. The dedicated website wasn’t enough efficient to support unexpected self-guided rehabilitation. Self-guided rehabilitation could benefit of improvement of interactive that must be at least as effective as supervised-rehabilitation methods.

Category: Knee - ACL

Mid-Term Outcomes Of Repeated Revisions After Anterior Cruciate Ligament (Ac) Reconstructions With Allografts In Isolate And Complex Cases Of Multiple Failures

Abstract ID# 21982
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Summary:
Good mid-term clinical results can be obtained after repeated ACL revision with allograft in patients that experienced multiple failures, however, who need additional procedure due to malalignment or post-meniscectomy syndrome reported lower objective and subjective results.

Data:
Background: Anterior Cruciate Ligament (ACL) revision reconstruction are always complex scenarios due to eventual associated meniscal and cartilage lesion or degeneration. Nevertheless, these procedures have reached a satisfactory return to impact activity rate, and so the occurrence of an ACL revision reconstruction failures is destined to increase. Only few studies with a limited number of patients focused on clinical outcomes of multiple ACL revision reconstruction reporting contrasting results. Purpose: To evaluate the mid-term clinical outcomes of a cohort of patients who underwent multiple ACL revision reconstruction. The hypothesis was that patients with pre-existing meniscal deficiency conditions, malalignment and cartilage degeneration would have obtained lower results. Study Design: retrospective cohort study Methods: All cases of Multiple ACL Revisions performed with Allograft tissue at one single sport-medicine institution were extracted and patient’s whith a minimum 2 years of follow-up included. WOMAC, Lysholm, IKDC, Tegner activity level before injury and at last follow-up was collected and laxity evaluated with KT-1000 arthrometer and KIRA triaxial accelerometer. Results: From a cohort of 241 ACL revision, 28 patients (12%) with Repeated ACL Revision reconstructions were included. Fourteen cases (50%) were