

Increased Incidence of Knee Injuries Following Concussions

Katie M Zehner¹, Julian Smith-Voudouris¹, Joshua G Sanchez¹, Jeremy K Ansah-Twum¹, Elizabeth C Gardner¹, Jonathan N Grauer,¹
¹Yale School of Medicine, New Haven, CT
katie.zehner@yale.edu

Disclosures: Katie M Zehner (8- Associate Editor of Visual Abstracts, North American Spine Society Journal), Julian Smith-Voudouris (N), Joshua G Sanchez (N), Jeremy K Ansah-Twum (N), Elizabeth C Gardner (9-AOSSM Team Physician Committee, 9- NCAA Committee on Competitive Safeguards and Medical Aspects of Sports), Jonathan N Grauer (8- North American Spine Society Journal Editor-in-Chief, 8-Journal of the American Academy of Orthopedic Surgeons Deputy Editor, 9- North American Spine Society past board member)

INTRODUCTION: Concussions are common injuries in both elite and amateur athletes. Prior biomechanics and elite athlete cohort studies have suggested elevated risk of lower extremity injuries following concussion. However, the timing and level of injury risk in the general population are not well characterized.

METHODS: Patients presenting with a first diagnosis of concussion without loss of consciousness were identified from the 2010-2023 PearlDiver M170 database. As all data in PearlDiver has been aggregated and deidentified, our institutional IRB has deemed studies utilizing this database as exempt from review.

Baseline knee injury incidence rates (IRs) were quantified in the population prior to concussion. Subsequently, IRs for acute medial collateral ligament (MCL), lateral collateral ligament (LCL), medial meniscus, lateral meniscus, and cruciate ligament injuries were quantified for the two years following concussion.

Comparisons of IRs from after relative to before concussion were assessed by Poisson's exact method for incidence rate ratios (IRRs). A Bonferroni correction was applied to adjust for multiple comparisons. Patient factors independently associated with knee injury following concussion were assessed by multivariable analyses.

RESULTS SECTION: Overall, 1,270,170 patients with a concussion were identified. A significant increase in IR was seen in nearly all injuries studied in the months after concussion, with the highest IRR in the 1 month after concussion for most injuries (1 month IRRs: MCL 1.70, $p < 0.0001$ and shown in Figure 1 as an example of such plots; LCL 1.66 $p < 0.0001$; cruciate ligament 1.82 $p < 0.0001$; lateral meniscus 1.27, $p = 0.0011$; medial meniscus 1.15, $p = 0.0147$). While most IRs returned to baseline range within 2-9 months, incidences of cruciate ligament and lateral meniscus injuries were significantly elevated across the study period.

An independent predictor of knee injury after concussion was Elixhauser Comorbidity Index (odds ratio=1.04, $p < 0.0001$) but not patient age or sex.

DISCUSSION: This study investigates knee injury incidence following concussion (relative to before) in the general population on the largest scale to date. Elevated incidence of all knee injuries in the acute post-concussive period is consistent with literature in elite athletes, suggesting this risk remains even in the absence of intense pressure to return to sport. Persistently elevated incidence of cruciate ligament and lateral meniscus over the two-year study period suggests some alterations in biomechanics and/or neurocognition may persist indefinitely and warrant further study.

SIGNIFICANCE/CLINICAL RELEVANCE: There is an elevated incidence of knee injuries in the acute post concussive period, and providers should consider this in their management of return to activity or sport. Further research is necessary to identify those patients who are most at risk and may benefit from further biomechanical testing prior to increasing activities associated with higher knee injury risk after concussion.

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IMAGES AND TABLES:

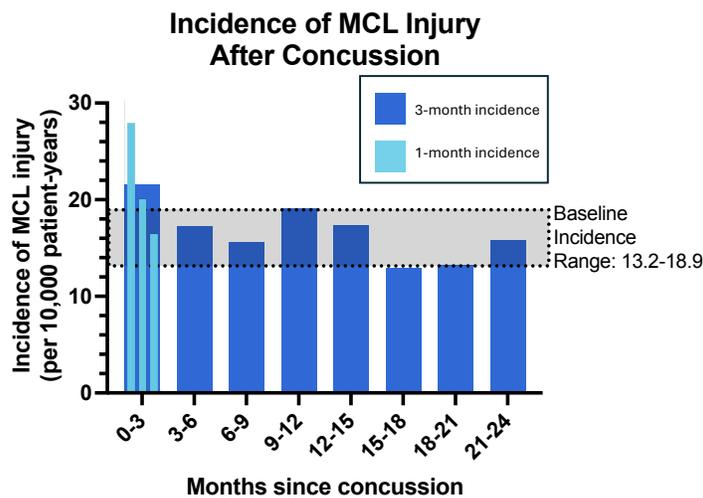


Figure 1. Incidence of medial collateral ligament injury following first episode of concussion without loss of consciousness, presented as an example of injury trend. Dark blue bars represent cumulative incidence over 3-month periods, while light blue bars represent cumulative incidence in one-month intervals. Gray box representing minimum and maximum values of incidence from 3-month intervals in the 1.75 years prior to concussion