Prior Isolated Medial Bucket-Handle Meniscus Repair Significantly Increases Risk of Subsequent Ipsilateral Anterior Cruciate Ligament Reconstruction: An Analysis of 438 Patients

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Summary:
Patients with prior surgically treated isolated meniscus tears are significantly more likely to require subsequent ipsilateral ACL-R surgery.

Data:
Background: Meniscus tears in a young population often occur from a traumatic, rotational mechanism of injury, which is similar to that of an ACL tear. However, there is limited evidence regarding the risk of subsequent ACL injury following a surgically treated isolated meniscus tear. Purpose: The purpose of this study was to evaluate isolated isolated medial meniscus repair compared to first-time ACL-R in the general population. The hypothesis was that a prior meniscus tear, more specifically a bucket-handle tear, is indicative of a more severe injury occurred to the knee and thus increases the risk of subsequent ipsilateral ACL-R. Methods: A retrospective review of a national database was conducted from 2015 to 2020 to identify patients, aged 10 to 40, who underwent primary isolated BH meniscus surgery. Patients were stratified by meniscal tear laterality and operative method. A control group of 500,000 age-matched patients was randomly selected to establish a benchmark rate of ACL-R. Kaplan-Meier analysis was performed to compare the timing and incidence of subsequent ipsilateral ACL-R after primary isolated BH meniscus repair to the control group within 2 and 5 years after index surgery. Results: In total, 1,767 patients with isolated bucket-handle meniscus tears (BHMT) treated with surgery were identified and met inclusion criteria. The incidence of isolated BHMT among all surgically treated meniscal injuries was 1.67%. Isolated BH repairs had significantly increased odds of ACL-R within 5 years compared to the control group (OR, 6.09; 95% CI, 2.86-12.99; P<0.001). Medial BH repairs had the highest odds of ACL-R within 5 years (OR, 9.15; 95% CI, 4.27-19.57; P<0.001). Lateral BH repair was not associated with subsequent ipsilateral ACL-R within 5 years (OR 2.63; CI 0.37-18.90; p=0.340). Conclusion: Isolated BH tears comprised 1.67% of all surgically-treated meniscal injuries. Patients who underwent prior surgery for an isolated BH meniscal tear were at increased risk of undergoing subsequent ipsilateral ACL reconstruction compared to the general population. Isolated medial BHMT treated with repair had the highest risk for subsequent ipsilateral ACL-R. This study should raise awareness amongst physicians when treating isolated medial BHMT to perform careful examination of the ACL and examination under anesthesia for potential laxity or rotation instability.

Category: Knee - ACL

Unsupervised Machine Learning of the Combined Danish and Norwegian Knee Ligament Registers Identifies Five Discreet Patient Groups With Differing ACL Revision Rates

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Summary:
Unsupervised machine learning analysis of the combined Danish and Norwegian knee ligament registers enables quick risk stratification into high, medium, or low risk categories for future patients undergoing ACL reconstruction with hamstring or BTB.

Data:
PURPOSE: Most of the machine learning applications within the orthopaedic literature to date have utilized a “supervised” learning approach aimed at making predictions and classifications based on labeled variables within a dataset. In contrast, “unsupervised” learning represents a machine learning technique that allows the computer to independently find patterns in a dataset without a pre-specified outcome. The purpose of this study was to apply unsupervised machine learning to the combined Danish and Norwegian Knee Ligament Registers (KLR) with the goal of detecting distinct subgroups within the dataset. The hypothesis was that this analysis would identify groups of patients with differing rates of subsequent anterior cruciate ligament reconstruction (ACL-R) revision that could be used to categorize a future patient and quickly estimate their revision risk in the clinical setting. METHODS: A type of unsupervised learning known as clustering was performed on the complete case KLR data. Since the KLR contain both continuous and categorical variables, a clustering method known as “k-Prototypes” that accommodates both continuous and categorical data was used. As with many clustering methods, k-Prototypes requires pre-specification of the number of clusters. A combination of data-driven methods and domain knowledge were used to arrive at a target of five clusters. After performing the unsupervised learning, clinically relevant characteristics of each cluster were obtained using variable summaries and surgeons’ domain knowledge. Kaplan-Meier survival curve was created for the clusters. RESULTS: Five patient clusters were identified with the following characteristics: Cluster 1 (revision rate = 9.8%) patients were young (22 ± 7 years), female (73%), with Hamstring Tendon (HT) autograft (89%). Cluster 2 (revision rate = 6.5%) patients were young (24 ± 9 years), male (67%), with HT (91%). Cluster 3 (revision rate = 4.3%) patients were older (38 ± 9 years) undergoing HT reconstruction (93%). Cluster 4 (revision rate = 4.2%) patients received patellar tendon (BTB) autograft (86%) with low baseline Knee Injury and Osteoarthritis Outcome Score (KOOS) Sports score (21.3 ± 14.8). Cluster 5 (revision rate = 4.7%) patients received BTB (85%) and had higher baseline KOOS Sports scores (66.8 ± 16.8). DISCUSSION: Unsupervised learning enabled the identification of five distinct patient subgroups among patients undergoing ACLR with either HT or BTB autograft. Each grouping was associated with its own rate of subsequent ACLR revision. Patients can be classified into one of the five clusters based on only four variables: sex, age, graft choice (HT or BTB autograft), and preoperative KOOS sports subscale score. Patients receiving other graft choices do not fit into the current model, which was limited by the relatively low number of patients within the dataset that received alternate grafts. The resulting groupings will enable quick risk stratification for future patients undergoing ACLR with HT or BTB in the clinical setting. Patients in Cluster 1 are considered high risk (9.8%), Cluster 2 patients are medium risk (6.5%), while patients in Clusters 3-5 are considered low risk (4.2-4.7%) for experiencing subsequent revision ACLR. Level of Evidence: II