surgical variables, infection characteristics and incidence of ACL graft retention were collected for all included patients. Post-operative septic arthritis was defined by at least 1 of the following criteria: purulent drainage from a deep incision, knee joint aspiration suggestive of a bacterial infection, culture-positive aspiration, or positive physical examination findings consistent with septic arthritis. The Mann-Whitney U test was used for group comparisons for nonparametric values or where normality assumption was violated. Depending on the sample, the chi-square test or Fisher exact test (n < 5) was used to analyze discrete variables. Results: 6,741 patients were included in this study. The most commonly used graft was allograft (n = 2,510, 37.2%), followed by HT (n = 1,784, 26.5%), BTB (n = 1,488, 22.1%), and QT (n = 959, 14.2%) autografts. The overall post-operative infection rate was 0.34% (n = 23). Infection rates based on graft type were 0.72% for HT allograft, 0.23% for allograft, 0.20% for BTB autograft, and 0.10% for QT autograft. A statistically significant difference in infection rate was observed between QT and HT autografts (p < 0.05), but not between QT and BTB autografts or QT and allograft (p > 0.05 for both). All grafts were retained during irrigation and debridement treatment. The mean time from the index surgery to the onset of symptoms was 29 days (min: 5, max: 69). Staphylococcus aureus (n = 2) and Enterococcus faecalis (n = 2) were the most common bacterial pathogens in culture-positive septic arthritis cases (n = 10, 43.4% of all infection patients). Conclusion: Septic arthritis was detected at an overall rate of 0.34% after ACLR, with the highest rate being observed after the use of HT autograft (0.73%). QT autograft (0.1%) was found to have the lowest infection rate of all graft types, and was significantly lower than HT autograft. Surgeons can utilize this information when counseling patients on the risks of graft options for ACLR and determining ideal graft choice.

Category: Knee - Other

Anterolateral and Direct Lateral Tunnel: Two Safe Zones for Femoral Drilling During All-Epiphyseal Anterior Cruciate Ligament Reconstruction – A Digital Three-Dimensional MRI Simulation Model Study

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Summary: Anterior Cruciate Ligament (ACL) all-epiphyseal technique aims to avoid the distal femoral physis, nevertheless other adjacent structures could be at risk. This study evaluated two safe zones for the femoral tunnel drilling during this technique in patients with open growth plates. The anterolateral (AL) direction showed a larger safe area and longer tunnel length.

Data: Purpose Damage to the distal femoral physis (DFP) should be minimized during Anterior Cruciate Ligament (ACL) reconstructions in patients with open growth plates. All-epiphyseal technique aims to avoid the DFP, nevertheless, other adjacent structures such as the articular surface, the lateral collateral ligament (LCL), the anterolateral ligament (ALL), and the popliteus tendon (PT) could be at risk. Current knowledge about safe zones and ideal tunnel orientation is limited. The objective of this study was to investigate the safe zones for femoral tunnel drilling in all-epiphyseal ACL reconstructions and its relation with at-risk structures. Methods Eighty magnetic resonance images (MRI) from patients aged 10 to 17 were obtained and randomly sampled from the institutional database, with a homogeneous distribution of age and sex. A de novo software was developed to obtain three-dimensional (3D) models of the distal femur and DFP. In each model, the femoral footprints of the ACL, LCL, ALL, and PT were identified, as established in cadaveric and imaging studies by previous authors. Drillings were simulated using 7-, and 8-mm drills, starting from the ACL femoral insertion at every possible angle within a 90° cone. Safe zones were defined as the direction in which neither the DFP, LCL, ALL, PT nor articular surface were violated. The segmentation, measurement, and statistical analysis were developed in MATLAB software. Statistical analysis was conducted using Student’s t-test, one-way ANOVA, and simple linear regression. Statistical significance p < 0.05. Results A total of 52 knees with open DFP were obtained, median age 13 (IQR 10-17), 59.6% men. Two safe zones were found: an Anterolateral (AL) and a Direct Lateral (DL) direction. For both 7- and 8-mm tunnels, the AL orientation had a larger safe area and a longer drilling length than the DL (p < 0.01). The mean safe area of the AL direction for the 7- and 8-mm tunnels were 408 y 384 mm² respectively (p < 0.05). The mean safe area of the DL orientation for the 7- and 8-mm tunnels were 236 y 219 mm² respectively (p < 0.05). The mean length for the AL direction was 34.2 mm and for the DL was 27.4 mm (p < 0.05). There were no statistical differences between sex or age. Conclusions This 3D MRI simulation model study identified two safe zones for the femoral tunnel drilling during the all-epiphyseal ACL reconstruction technique in patients with open growth plates. The AL direction showed a larger safe area and longer tunnel length.

Category: Knee - Other

BMAC Augmentation of Allograft Anterior Cruciate Ligament Reconstruction Improves Patient Reported Outcomes in the Presence of Intra-Articular Pathology

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Summary: Amongst patients with concurrent meniscus and/or cartilage lesions, patients with BMAC had an 8-point higher mean IKDC score than controls at 9 months postoperatively; however, there was no difference in mean IKDC score between BMAC and control groups if no concurrent pathology was present.

Data: Background: A randomized control trial demonstrated evidence of earlier graft remodeling and improved 9-month International Knee Documentation Committee (IKDC) scores when anterior cruciate ligament reconstruction (ACLR) with bone-tendon-bone allograft was augmented with an intra-graft injection of bone marrow aspirate concentrate (BMAC). While these results are promising, the mechanism by which BMAC may affect patient reported outcome measures (PROMs) following ACLR is unclear. Methods: This was a sub-analysis of patients enrolled to date in an IRB-approved, double-blinded, randomized control trial comparing patients undergoing ACLR with BTB allograft ± BMAC. Only patients who had completed at least 9 months follow-up were included. Patients were stratified by 1) treatment arm (BMAC versus control) and 2) presence of concurrent meniscus or cartilage pathology, as noted on diagnostic arthroscopy. The primary outcome was the Tegner activity scale and International Knee Documentation Committee (IKDC) at 9 months. A secondary sub-analysis assessed differences in MRI characteristics (signal intensity ratio [SIR], graft volume) by group. Results: The final study cohort included 44 BMAC patients – 19 (43%) without and 25 (57%) with concurrent cartilage or meniscus pathology – and 39 control group patients - 16 (41%) without and 23 (59%) with concurrent cartilage or meniscus pathology. 24 patients in the BMAC group had a meniscus lesion, 13 of which were treated via meniscectomy (54%) and 11 by meniscus repair (46%). By comparison, 21 patients in the control group had a meniscus lesion (P = 0.57), 11 who were treated with meniscectomy (52%, P = 0.88) and 11 who had a meniscus repair (P = 1.00). 5 patients with BMAC (20%) and 6 control patients (25%) had a cartilage injury noted intraoperatively (P = 0.94); chondroplasty was performed in 2 patients in the BMAC group (8.0%) and 4 patients in the control group (16.7%). Tegner score at 9 months did not differ by BMAC treatment or presence of concurrent meniscus/cartilage pathology (P = 0.816). If a patient had a concurrent meniscus and/or cartilage lesion, the group treated with BMAC had a greater mean IKDC at 9 months (81.7 [SD = 10.2] vs. 74.3 [SD = 14.6], P = 0.039). If a patient had no concurrent pathology, there was no difference in IKDC scores by treatment group (P = 0.80). Change in Tegner (P = 0.99) and IKDC (P = 0.31) did not differ by groups. At 3 months, patients with BMAC and concurrent pathology had the highest mean SIR in the inferior 1/3 of the graft (3.00), followed by patients with BMAC but no concurrent pathology (2.60), controls without concurrent pathology (1.95), and controls with concurrent pathology (1.83, P = 0.041). There were no significant differences in SIR at 9 months or
graft volume, in this comparative cohort study. Discussion: Amongst patients with concurrent meniscus and/or cartilage lesions, patients with BMAC had an 8-point higher mean IKDC score than controls at 9 months postoperatively. However, there was no difference in mean IKDC score between BMAC and control groups if no concurrent pathology was present. Thus, improved IKDC amongst patients with BMAC may be mediated by improved healing of repaired tissue or through an undefined anti-inflammatory or nociceptive pathway. Further investigation will be required to delineate a physiologic mechanism of action associated with BMAC during the recovery process when utilized at the time of ACL allograft reconstruction.