Patients with Medial Meniscus Posterior Root Tear have Small Medial Proximal Tibial Angle, Large Medial Femoral Condyle Angle, and Narrow Intercondylar Notch

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INTRODUCTION:

Early repair of medial meniscus posterior root tear (MMPRT) is crucial due to its potential to cause progressive knee osteoarthritis. While risk factors such as advanced age, female gender, squatting movements, high BMI, and varus knee have been identified, the specific bone morphology associated with MMPRT remains unclear. This study aims to evaluate the differences in bone morphology between patients with and without MMPRT. METHODS:

Patient Selection: This study included patients diagnosed with MMPRT or spontaneous osteonecrosis of the knee (SONK) at our institution between 2016 and 2023. MRI images were used to measure the posterior tibial slope (PTS) in the sagittal plane, medial proximal tibial angle (MPTA) in the coronal plane, notch width (NW) / intercondylar distance (ICD), condylar twist angle (CTA), and medial femoral condyle angle (MFCA) in the horizontal plane. MMPRT was defined by the presence of a vertical linear sign on the coronal plane or a white meniscus sign on the sagittal plane (Figure 1). Patients were divided into two groups: Group M (with MMPRT) and Group N (without MMPRT). The parameters were compared between the two groups.

MRI Parameters:

PTS: In the sagittal plane, the angle between the proximal tibial articular surface and a line (RL) perpendicular to the line connecting the anteroposterior center of the tibia at a level 5 cm distal to the proximal tibial articular surface with the anteroposterior center of the tibia at a level 1 cm proximal to the most distal part of the imaging range (Figure 2).

MPTA: In the coronal plane, the angle formed by the line connecting the medial and lateral central points at a level 5 cm distal from the articular surface with the medial and lateral central points at a level 1 cm proximal from the most distal part of the imaging range and the proximal articular surface of the tibia.

MFCA: The angle between the line connecting the centers of the two circles tangent to the anterior part of the medial femoral condyle and the line connecting the centers of the two circles tangent to the posterior part of the medial femoral condyle in the horizontal plane (Figure 3).

CTA: The angle formed by the surgical epicondylar axis (SEA) and the posterior condylar angle (PCA), with external rotation of the SEA relative to the PCA being positive.

NW: The posterior-most distance of the femoral intercondylar notch.

ICD: The distance between the medial and lateral femoral epicondyles (Figure 4).

Statistical Analysis: Comparisons of patients' backgrounds and parameters measured by MRI were performed using a ttest. Categorical variables, such as sex, were compared using the chi-squared test. All statistical analyses were performed using SPSS version 29 (IBM Corporation, Armonk, New York, USA). A p-value less than 0.05 was considered statistically significant.

RESULTS:

A total of 51 patients were included in the study. The background characteristics of each group are presented in Table 1. Group M had a higher proportion of females (85.3% vs. 53%, p=0.029) and shorter height (152.8 cm vs. 158.6 cm, p=0.03) compared to Group N. MRI measurements are shown in Table 2. Group M had a significantly smaller MPTA (86.5° vs. 87.5°, p=0.014), a significantly larger MFCA (49.9° vs. 44.4°, p=0.006), and a significantly smaller NW/ICD (0.25 vs. 0.27, p=0.009) compared to Group N.

DISCUSSION AND CONCLUSION:

Discussion: In this study, the group with MMPRT exhibited a smaller MPTA, a larger MFCA, and a smaller NW/ICD. The smaller MPTA is likely influenced by the increased medial sliding force of the femur. The larger MFCA may be due to the increased rotational force acting on the site of the MMPR. Additionally, the smaller NW/ICD is thought to result from the increased load on the MMPR site due to the medial overhang between the condyles.

Conclusion: A smaller medial proximal tibial angle, a larger medial femoral condyle angle, and narrow intercondylarnotchareassociatedwithMMPRT.