

Take-home message: MRI-derived popliteal artery wall eccentricity ratio - a marker of focal, asymmetric arterial remodeling - was associated with baseline medial tibial cartilage damage and BML severity, but not 24-month structural worsening.

BACKGROUND / PURPOSE

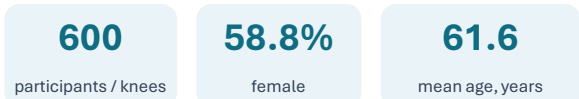
- Vasculopathy may contribute to knee OA, but evidence remains inconsistent.
- Knee MRI can opportunistically capture popliteal artery wall morphology.
- Objective: test whether DL-derived artery wall biomarkers associate with baseline and 24-month medial compartment cartilage damage and BMLs.

COHORT / STUDY DESIGN

FNIH OA Biomarkers Consortium: 600 Knees



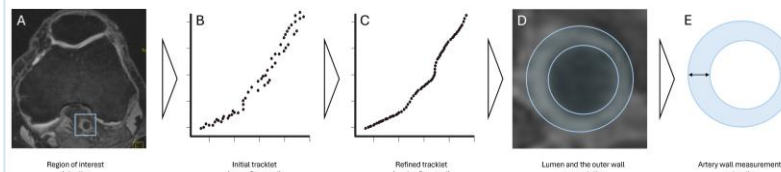
Nested FNIH OA Biomarkers Consortium cohort within OAI. One knee per participant; baseline KL 1-3; knee MRI and radiographs at baseline and 24 months.



STATISTICAL ANALYSIS

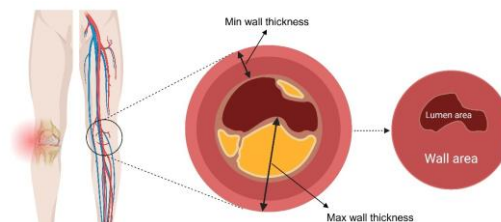
- **Exposures**
Eccentricity ratio, NWI, wall/lumen area, wall thickness
- **Outcomes**
MOAKS medial tibiofemoral cartilage damage and BML scores at baseline and 24 months
- **Models**
Linear regression; Model 1 adjusted for age, sex, BMI; Model 2 additionally adjusted for FNIH subgroup. Sex-stratified sensitivity analyses.

IMAGING / DEEP LEARNING PIPELINE



FRAPPE: automated localization, centerline refinement, lumen/outer-wall segmentation, and biomarker extraction from baseline 3D DESS knee MRI.

MEASURED BIOMARKERS

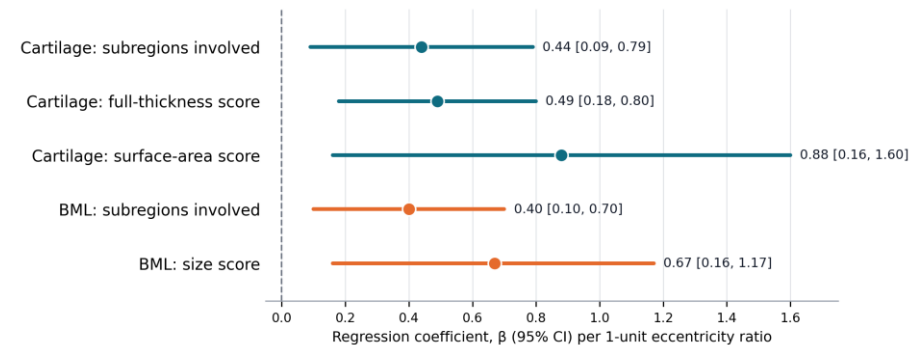


- Eccentricity ratio**
Max / min wall thickness
Focal/asymmetric thickening
- Mean NWI**
Wall area / total vessel area
Diffuse burden metric
- Wall / lumen area**
Cross-sectional vessel geometry and remodeling

Clinical readout: MOAKS cartilage damage and BMLs were scored in medial tibiofemoral subregions at baseline and 24 months.

PRIMARY RESULTS

Higher eccentricity ratio associated with baseline medial tibial cartilage damage and BML severity



Model 2: adjusted for age, sex, BMI, and FNIH OA Biomarkers Consortium subgroup. Positive β indicates greater structural severity.

Longitudinal interpretation: no association with 24-month structural worsening, possibly reflecting slow OA progression and limited follow-up duration.

KEY FINDINGS / IMPACT

- Not predictive of 24-month worsening**
- Cartilage signal stronger in males**
- Opportunistic no extra acquisition**

- Eccentricity ratio was the most consistent vascular biomarker.
- Findings were localized to medial tibial subregions rather than the medial femur.
- Results support a vascular-musculoskeletal interface in established medial knee OA burden.

Conclusion: Opportunistic DL-derived popliteal artery eccentricity ratio from routine knee MRI may provide a scalable marker of vascular remodeling associated with baseline medial tibial cartilage damage and BML burden in knee OA.