

Nasim Eshraghi, MD1; Peyman Mirghaderi, MD, MPH1 ; Farhad Pishgar, MD1 ; Chankue Park MD1 ; Niranjan Balu, PhD1 ; Ali Guermazi, MD, PhD4 ; Majid Chalian, MD1

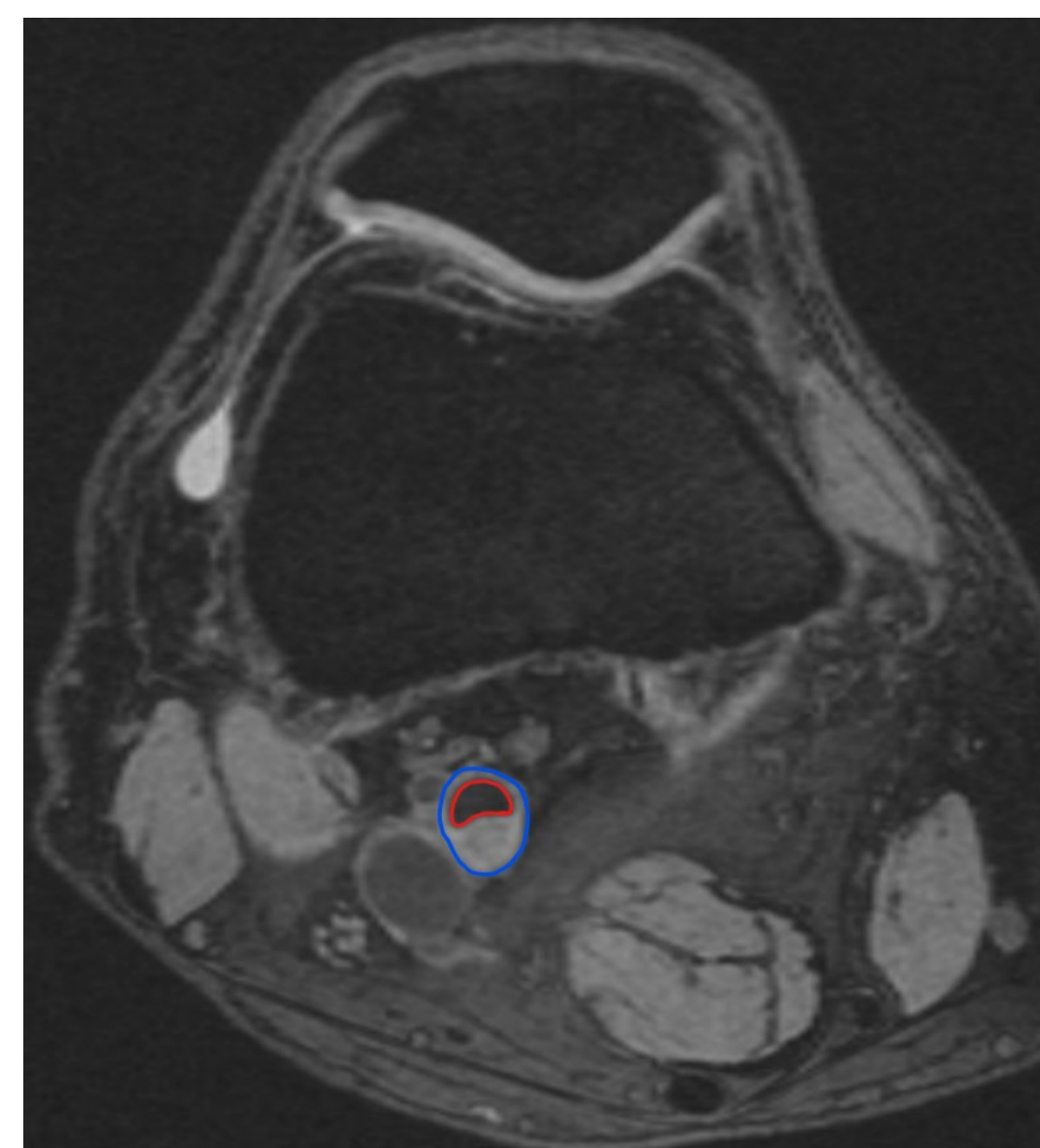
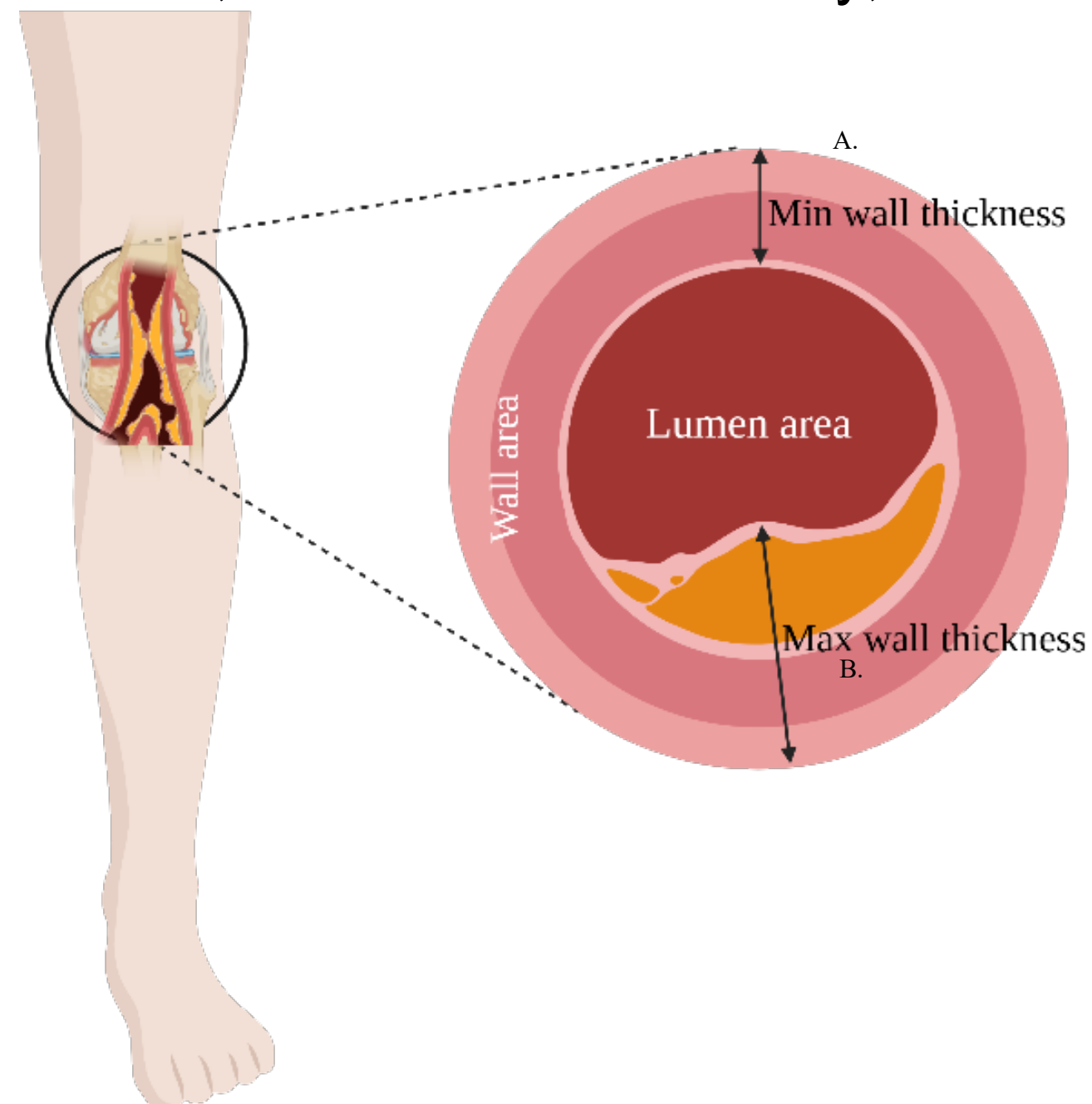
1. University of Washington, Seattle, WA
2. Boston University, Boston, MA

BACKGROUND

- Atherosclerotic arterial changes may contribute to knee OA through reduced periarticular and subchondral perfusion.
- Popliteal artery wall parameters can be opportunistically quantified from routine knee MRI using automated segmentation.
- Cartilage T2 relaxation time reflects water content and collagen integrity and is a compositional biomarker of early cartilage degeneration.
- Gap: the association between MRI-derived popliteal artery remodeling and regional cartilage T2 remains poorly defined.

METHODS

- Retrospective longitudinal analysis of the Osteoarthritis Initiative (OAI).
- Final baseline analytic cohort: 4,447 individuals with right-knee cartilage T2 and popliteal artery wall metrics.
- FRAPPE automated segmentation of 3T sagittal DESS MRI provided wall thickness, lumen area, wall area, total artery area, eccentricity ratio and normalized wall index (NWI).
- Cartilage T2 was measured in lateral/medial tibia, lateral/medial femur and patella.
- Linear regression models adjusted for age, sex, BMI, smoking, diabetes, PASE and comorbidity; FDR correction applied.



RESULTS

Cross-sectional associations with baseline cartilage T2

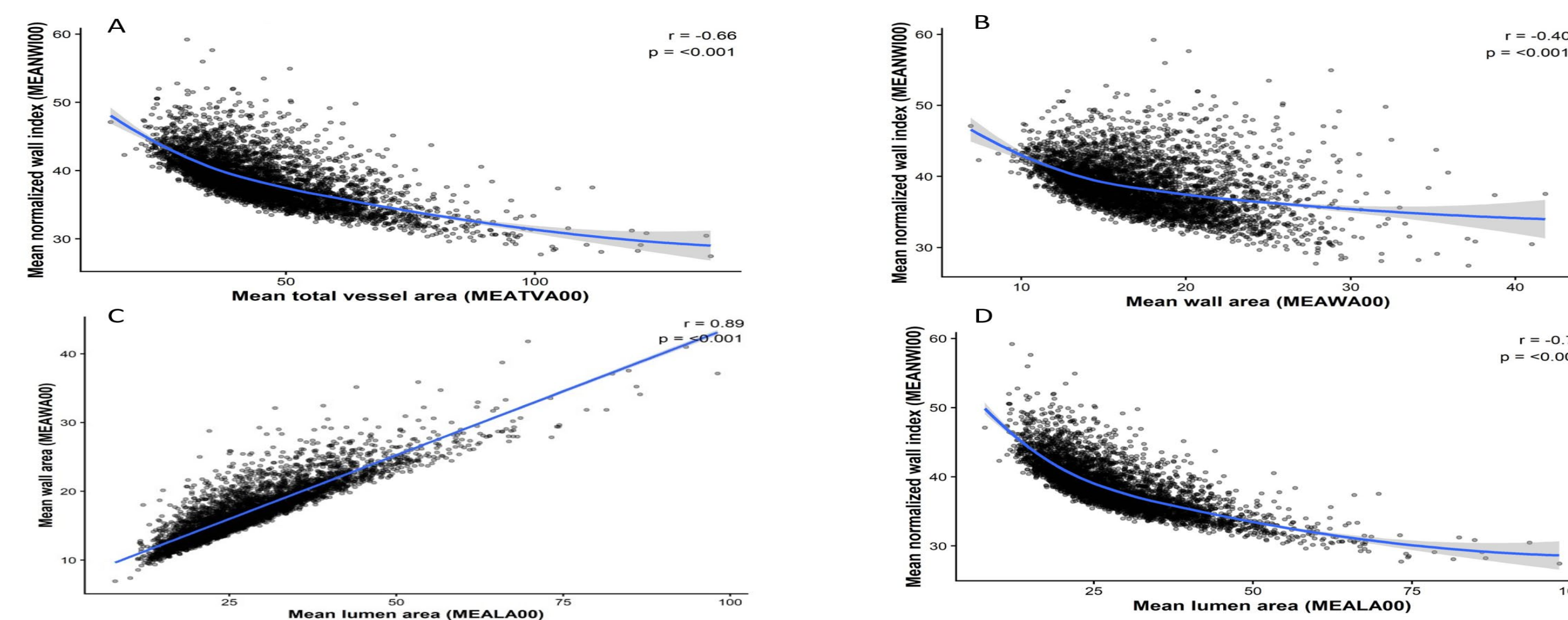
Baseline associations: popliteal artery metrics vs cartilage T2

	Lat tibia	Lat femur	Med tibia	Med femur	Patella
Wall thickness	0.13*	0.11*	0.07	0.03	0.01
Wall area	0.27*	0.30*	0.25*	0.25*	0.31*
Lumen area	0.27*	0.28*	0.25*	0.31*	0.45*
Total artery area	0.28*	0.29*	0.27*	0.31*	0.43*
NWI	-0.15*	-0.15*	-0.19*	-0.18*	-0.33*

Adjusted β per 1-SD arterial metric

* FDR-adjusted $q < 0.05$; models adjusted for age, sex, BMI, smoking, diabetes, PASE and comorbidity.

Baseline correlations among popliteal artery wall metrics



- Mean wall area, mean lumen area and mean total artery area were consistently associated with higher baseline cartilage T2 across all five subregions ($\beta = 0.25-0.45$; all $q < 0.001$).
- Mean NWI was inversely associated with cartilage T2 across all subregions ($\beta = -0.15$ to -0.33 ; all $q < 0.001$).
- Wall thickness was significant only in the lateral tibial and lateral femoral regions; maximum wall thickness and eccentricity ratio were not significant.
- Baseline arterial parameters did not predict 12- or 24-month $\Delta T2$ after accounting for baseline T2.
- KL-stratified analyses showed similar directions, with generally larger effect sizes in KL ≥ 2 knees.

DISCUSSION

- Baseline popliteal artery remodeling was linked to worse cartilage composition, suggesting a vascular contribution to OA-related cartilage matrix abnormality.
- The inverse association between NWI and T2 may reflect positive arterial remodeling: lumen and outer vessel dimensions enlarge as wall area increases, lowering the wall-to-total-area proportion.
- Lack of longitudinal prediction suggests baseline artery measures are a concurrent marker of cartilage composition rather than an independent short-term predictor of T2 change.
- Automated FRAPPE analysis enables scalable, opportunistic vascular assessment from knee MRI.

CONCLUSIONS

- Fully automated MRI-derived popliteal artery metrics were associated with cartilage T2 relaxation time at baseline.
- Total artery, lumen and wall area showed positive associations with T2, whereas mean NWI showed inverse associations.
- Baseline artery parameters did not predict short-term cartilage T2 change.
- Cartilage T2 and arterial metrics may capture complementary OA dimensions: radiographic structural severity versus pain-related vascular remodeling.

TAKE-HOME

- Larger wall, lumen and total artery areas were associated with higher baseline cartilage T2 across knee regions.
- Mean NWI was inversely associated with baseline cartilage T2, consistent with compensatory arterial remodeling.
- Baseline arterial metrics did not independently predict 12- or 24-month T2 change after baseline T2 adjustment.
- Arterial remodeling metrics were more strongly associated with WOMAC pain, while cartilage T2 was more strongly associated with KL grade.

REFERENCES

Selected: Chen et al. Magn Reson Med 2020; Canton et al. J Am Heart Assoc 2021; Wang et al. Rheumatology 2023; Prasad et al. Osteoarthritis Cartilage 2013; Liebl et al. Ann Rheum Dis 2015; Löffler et al. Arthritis Res Ther 2025.