

## Association between Carotid Atherosclerosis and Vertebral Metabolic Activity as Assessed by 18F-NaF PET/CT

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**ABSTRACT INTRODUCTION:** Sodium fluoride (18F-NaF) positron emission tomography (PET)/computed tomography (CT) is an established marker of skeletal metabolism and an emerging tracer of vascular microcalcification. Carotid calcification and bone remodeling share pathophysiological pathways, making the carotid–vertebral axis an important model for studying molecular alterations with PET that precede structural pathology.

**METHODS:** We analyzed 81 healthy adults from the Cardiovascular Molecular Calcification Assessed by 18F-NaF PET/CT (CAMONA) study who underwent NaF PET/CT. Standardized uptake values (SUV<sub>mean</sub>) were extracted for cervical (C1–C7), thoracic (T1–T12), lumbar (L1–L5), and sacral (S1) vertebrae, along with the left and right common carotid arteries. Multivariable linear regression was performed separately for each vertebra, adjusting for age, sex, and BMI. Bonferroni correction accounted for multiple comparisons.

**RESULTS:** Carotid NaF uptake was consistently and strongly associated with vertebral NaF uptake across all spinal levels (all corrected  $p < 0.001$ ). The largest effect sizes were observed in the lower lumbar and sacral vertebrae (e.g., L4:  $\beta = 9.05$ ,  $p < 0.001$ ; S1:  $\beta = 8.96$ ,  $p < 0.001$ ; L3:  $\beta = 8.80$ ,  $p < 0.001$ ). Associations in the cervical and upper thoracic spine were also significant but more modest (e.g., C1:  $\beta = 2.78$ ,  $p < 0.001$ ; T7:  $\beta = 2.78$ ,  $p < 0.001$ ). Across the remaining vertebral levels,  $\beta$  values generally ranged from 3.0 to 7.5, with all  $p < 0.001$  after Bonferroni correction.

**DISCUSSION:** Carotid NaF uptake is strongly associated with vertebral NaF uptake, independent of age, sex, and BMI. These results indicate a robust coupling between atherosclerotic microcalcification and vertebral metabolic activity.

**SIGNIFICANCE/CLINICAL RELEVANCE:** This study highlights the potential utility of NaF PET/CT as a noninvasive biomarker of systemic bone–vascular health with implications to enhance the early screening of pathology associated with worse surgical outcomes: atherosclerosis and osteoporosis.