Global molecular calcium score: is there a link between sodium fluoride uptake and cardiovascular risk burden?

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Background: Sodium fluoride (18F-NaF) uptake in positron emission tomography with computed tomography (PET-CT) identifies active microcalcification both in atherosclerotic plaques and the aortic valve.

Purpose: We aimed to evaluate global cardiac microcalcification activity with 18F-NaF, as a measure of the microcalcification burden, in high cardiovascular (CV) risk patients. Additionally, as an exploratory endpoint, we evaluated the association between global cardiac microcalcification and diastolic dysfunction.

Methods: High CV-risk individuals without previous CV events from a single centre were prospectively scanned with 18F-NaF PET-CT. Total cardiac 18F-NaF uptake was measured as global molecular calcium score (GMCS), which was calculated by summing the product of mean standardized uptake value and volume of the region of interest on every slice within the borders of the heart. The result was then divided by the number of slices to adjust for the volume.

Results: We included sixty-five patients with a mean age of 64.0 ± 9.0 years and 38.5% females. There was a high rate of CV risk factors, including hypertension (95.4%), diabetes (84.6%), dyslipidemia (78.5%), obesity (58.5%), smoking (26.2%) chronic kidney disease (18.5%), and family history of premature coronary disease (9.2%). The mean 10-year risk of fatal and nonfatal cardiovascular events predicted by ASCVD risk score was 30.54 ± 18.4. Median GMCS was 221.42 [IQR 144.55-317.58]. Individuals with > 5 CV risk factors (46.2%) had increased overall GMCS compared to those with a lower number of CV risk factors (295.29, IQR 159.37-356.87 vs 186.16, IQR 122.57-281.78; p=0.03). Thirty-three patients underwent diastolic dysfunction evaluation by echocardiography. All patients had normal left ventricle ejection fraction, mean of 62.86 ± 3.58%. Mean E/A was 0.88 ± 0.27, mean septal e’ velocity 0.07 ± 0.02 m/s, mean lateral e’ velocity 0.08 ± 0.02 m/s, and mean average E/e’ 10.7 ± 3.3. The mean peak tricuspid regurgitation velocity was 2.14 ± 0.59 m/s and the median indexed left atrium volume was 37, IQR 29-44mL/m². After applying the algorithm for diagnosis of diastolic dysfunction in subjects with normal ejection fraction, 21.2% had diastolic dysfunction and 36.4% had a normal diastolic function, while 42.4% were indeterminate. There was no correlation between echocardiographic variables of diastolic function and GMCS, except for indexed left atrium volume (r = 0.83, p<0.01). There was no association between GMCS and diastolic function categories.

Conclusions: In a high CV risk cohort, the global cardiac microcalcification assessed by GMCS was associated with the burden of CV risk factors. Additionally, despite a strong positive correlation between GMCS and indexed left atrium volume, we found no association between GMCS and echocardiographic variables of diastolic function.