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Association of PET index quantifying skeletal uptake in NaF PET/CT images with overall survival in prostate cancer patients.

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**Background:** Bone Scan Index (BSI) derived from 2D whole-body bone scans is considered an imaging biomarker of bone metastases burden carrying prognostic information. Sodium fluoride (NaF) PET/CT is more sensitive than bone scan in detecting bone changes due to metastases. We aimed to develop a semi-quantitative PET index similar to the BSI for NaF PET/CT imaging and to study its relationship to BSI and overall survival in patients with prostate cancer. **Methods:** NaF PET/CT and bone scans were analyzed in 48 patients (aged 53-92 years) with prostate cancer. Thoracic and lumbar spines, sacrum, pelvis, ribs, scapulae, clavicles, and sternum were automatically segmented from the CT images, representing approximately 1/3 of the total skeletal volume. Hotspots in the PET images, within the segmented parts in the CT images, were visually classified and hotspots interpreted as metastases were included in the analysis. The PET index was defined as the quotient obtained as the hotspot volume from the PET images divided by the segmented bone tissue volume from the CT images. BSI was automatically calculated using EXINIbone<sup>BSI</sup>. **Results:** The correlation between the PET index and BSI was  $r^2 = 0.54$ . The median BSI was 0.39 (IQR 0.08-2.05). The patients with a BSI  $\geq 0.39$  had a significantly shorter median survival time than patients with a BSI  $< 0.39$  (2.3 years vs. not reached after 5 years). BSI was significantly associated with overall survival (HR 1.13, 95% CI 1.13 to 1.41;  $p < 0.001$ ), and the C-index was 0.68. The median PET index was 0.53 (IQR 0.02-2.62). The patients with a PET index  $\geq 0.53$  had a significantly shorter median survival time than patients with a PET index  $< 0.53$  (2.5 years vs. not reached after 5 years). The PET index was significantly associated with overall survival (HR 1.18, 95% CI 1.01 to 1.30;  $p < 0.001$ ) and C-index was 0.68. **Conclusions:** PET

index based on NaF PET/CT images was correlated to BSI and significantly associated with overall survival in patients with prostate cancer. Further studies are needed to evaluate the clinical value of this novel 3D PET index as a possible future imaging biomarker.

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