Association between radiomic features and outcomes after metastasis-directed radiotherapy

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Background: Metastasis-directed radiotherapy (MDT) is a mainstay in the management of oligometastatic prostate cancer (PCa), and PSMA-PET is currently the most sensitive imaging modality for PCa metastasis screening. The efficacy of MDT guided by PSMA-PET imaging with and without androgen signaling inhibitor therapy (ASI) has not yet been well characterized. We sought to assess the efficacy of PSMA PET-guided MDT in patients with metastatic PCa and to assess PSMA-PET features associated with outcomes.

Methods: This is a single institutional retrospective study of patients diagnosed with metastatic prostate cancer by PSMA-PET imaging who were treated with MDT. Survival analyses were performed using the Kaplan-Meier method with Cox proportional hazards testing for significance. Cumulative incidence analyses were performed with Gray's testing for significance.

Results: 194 metastatic lesions from 101 patients identified by PSMA PET were irradiated with MDT. 79 patients had hormone-sensitive PCa (HSPC) and 22 patients had castration-resistant PCa (CRPC) at time of MDT. 47 of 79 (59%) patients with HSPC received ASI along with MDT. 4 of 194 lesions (2.1%) demonstrated radiographic progression. SUVmax median for all PET-avid lesions treated with MDT was 11.5, and SUVmax median of the 4 lesions that subsequently developed in-field progression was 40.3. 2-year cumulative incidence of progression from HSPC to CRPC was 11% in patients who received ASI at time of MDT and 35% in those who did not (P=0.027). Median biochemical progression free survival of patients with CRPC, HSPC treated without ASI, and HSPC treated with ASI following MDT was 5.4, 7.6, and 43.9 months respectively (P<0.0001). 2-year overall survival of the abovementioned groups was 72.2%, 100%, and 97.5% respectively (P<0.001). The following imaging features were investigated on the full cohort, and none were associated with biochemical PFS on univariable analysis: SUVmax, tumor volume, flatness, elongation, sphericity, first-order entropy, or first-order energy (P > 0.05). No Grade 3-5 adverse effects were observed.

Conclusions: MDT guided by PSMA-PET imaging is well-tolerated and delays biochemical progression in patients with CRPC and HSPC. Patients with HSPC may benefit from concurrent use of ASI with MDT, though confirmatory studies are needed.

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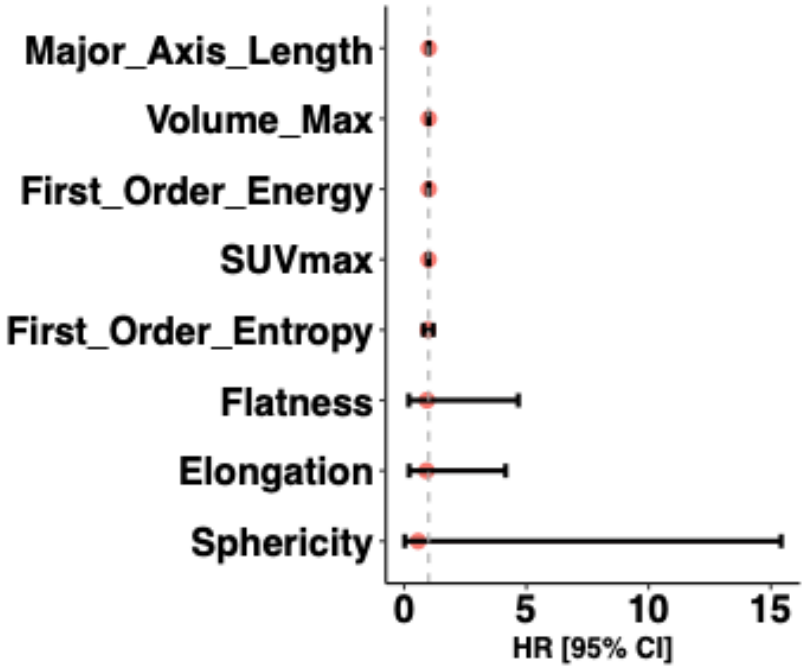

Figure 1. Forest plot depicting association between select imaging features and biochemical PFS.