Background: Although nivolumab has been widely adopted as a treatment for advanced RCC, only a minority of pts benefit. We aimed to use radiomics as a predictive biomarker. By extracting quantitative information from serial imaging, this non-invasive method captures the spatial and temporal heterogeneity of tumors, more than tissue biopsy. We hypothesized to find an imaging correlate of host immune recognition, characterized by infiltration of the intra-tumor margin by immune effector cells, that would identify pts to benefit from nivolumab.

Methods: We retrospectively identified all advanced RCC pts treated with nivolumab at our institution from 2013-2017. Pts were labelled as responders (CR/PR/durable SD) or non-responders based on clinical data. For each pt, lesions were contoured from pre-treatment and first on-treatment CT scans. All lesions were manually contoured in tandem by two trained investigators. This information was used to train a radial basis function support vector machine classifier to learn a prediction rule to distinguish responders versus non-responders. The classifier was internally validated by 10-fold nested cross-validation.

Results: 37 pts were identified. Excluded: imaging unavailable = 3, incompatible CT protocols = 7, 104 lesions were contoured from 27 pts. Median age 56 years, 78% male, 89% clear cell histology, 89% prior nephrectomy, 89% prior systemic therapy, 19 responders vs 8 non-responders. Lesions: 66% lymph nodes, 23% lung metastases, 17% renal/ adrenal metastases. For the classifier trained on the baseline CT scans, 69% accuracy was achieved. For the classifier trained on the first on-treatment CT scans, 66% accuracy was achieved.

Conclusions: Based on preliminary computations, the radiomics signature could discriminate nivolumab responders from non-responders. Additional texture feature analysis with over 72 billion calculations is underway to improve the classifier performance to discriminate tumor responses to immunotherapy. External validation against the comprehensive patient dataset from the International Metastatic Renal Cell Cancer Database Consortium is planned.

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