Contribution ID: **32** Type: **Oral**

PET/CT radiomics for prediction of hyperprogression in metastatic melanoma patients treated with immune checkpoint inhibitors

Thursday, 27 October 2022 14:45 (10 minutes)

Purpose: This study evaluated pretreatment FDG-PET/CT-based radiomic signatures for prediction of hyperprogression in metastatic melanoma patients treated with immune checkpoint inhibition (ICI).

Material and method: 56 consecutive metastatic melanoma patients treated with ICI and available imaging were included in our study and 330 metastatic lesions were individually segmented on pre-treatment CT and 2[18F]fluoro-2-deoxy-D-glucose (FDG)-PET imaging. Lesion hyperprogression (HPL) was defined as lesion progression according to RECIST 1.1 and doubling of tumor growth rate, whereas patient hyperprogression (PD-HPD) was defined as progressive disease (PD) according to RECIST 1.1 and presence of at least one HPL. Pre-treatment PET/CT-based radiomic signatures were used to build models predicting HPL at three months after start of treatment. The models were internally validated with nested cross-validation.

Results: Of all lesions, 69 (20.9%) were identified as progressing at 3 months. 29 of these lesions were classified as hyperprogressive, thereby showing a HPL rate of 8.8%. PD-HPD patients constituted 57.1% of all PD patients. PD-HPD was negatively related to patient overall survival with HR=8.52 (95%CI 3.47-20.94). Our best model predicting HPL at three months after the start of treatment achieved AUC=0.753 +/- 0.028 in training and AUC=0.685 +/- 0.089 in testing. The model relied on CT-based histogram and texture features.

Conclusions: FDG-PET/CT-based radiomic signatures yield potential for pretreatment prediction of hyperprogression, which may contribute to reducing the risk of delayed treatment adaptation in metastatic melanoma patients treated with ICI.

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Session Classification: Session II: Radiobiology, Radiomics, Adaptive RT

Track Classification: Miscellaneous