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Abstract

Confirmation of Independent Functional Liver Imaging Predictors of Survival in Cirrhotic Hepatocellular Carcinoma Patients

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Objectives: For cirrhotic patients with hepatocellular carcinoma (HCC), there is an unmet need for validated objective baseline and dosimetric parameters of functional liver. Standard assessment of liver function is limited by inclusion of subjective variables (e.g. Child-Pugh [CP]) score) and/or absence of regional information (e.g. ALBI, indocyanine green clearance, MELD). Anatomic-based dosimetry does not incorporate organ function, which can be problematic as many HCC patients may have heterogeneity due to prior liver-directed therapies (LDT). We confirmed the prognostic power of previously identified novel baseline and functional dosimetric values obtained using pre-radiotherapy (RT) [99mTc]-sulfur colloid (SC) SPECT/CT imaging.

Methods: Cirrhotic HCC patients that had pre-RT SC SPECT/CT imaging were retrospectively reviewed. SC SPECT scans were mined for previously identified imaging metrics of global liver function: liver-spleen mean uptake ratio (L/Smean), total liver function (TLF=FLV*L/Smean), and functional liver volume (FLV). RT doses were voxelwise converted to EQD2a/b=3 and GyRBE. Previously reported dosimetric parameters were calculated for the normal liver (liver-GTV) and FLV mean doses, dose-volumes (liver-GTV V20, FLV V20), and relative dose-function histogram (liver-GTV F20). Cox regression was performed for correlation to overall survival (OS). Receiver-operating characteristic (ROC) analysis was performed to determine dosimetric cutoffs.

Results: Eighty HCC patients with 66% Child Pugh (CP)-A or 34% CP-B/C cirrhosis were treated with SBRT (n=38) or proton RT (n=42). Thirty-six deaths occurred with a median OS of 27.9 months. Clinical and anatomic dosimetric metrics (e.g. baseline CP-class, tumor volume, liver-GTV mean dose and V20) performed similarly to functional dosimetric features (e.g. FLV mean dose and V20, liver-GTV F20) for predicting an increased risk of death from any cause on univariate analysis (all p< 25%, FLV V20GyEQD2 < 21%.

Conclusions: Our previously published objective functional liver baseline and dosimetric parameters using SC SPECT imaging retained significant correlation with overall survival in an expanded cohort of cirrhotic HCC patients treated with RT. Functional liver volume was an independent predictor of survival after adjusting for known baseline risk factors. Prospective

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validation in a clinical trial is underway.