**Abstract No. 3**

**FEATURED ABSTRACT**

**Clinical predictors of Yttrium-90 uptake in hepatocellular carcinoma: toward personalized dosimetry to maximize response to therapy**

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**Purpose:** To identify clinical factors and tumor characteristics that affect the relative uptake of Yttrium-90 (Y90) microparticles within hepatocellular carcinoma (HCC) in relation to surrounding perfused normal liver tissue

**Materials and Methods:** A retrospective review was conducted involving all patients who underwent pre-Y90 radioembolization planning with 99mTc-MAA hepatic artery embolization at a single institution from 2016 to 2020. Utilizing commercial software for individual dose planning (Simplicit90Y, Mirada Medical), pre-procedural MRI examinations were co-registered to 99mTc-MAA SPECT-CT images. The borders of the tumor as well as surrounding perfused normal liver were manually drawn. From these tumor and liver volumes, dimensionless image “counts” originating from each of these volumes were calculated automatically by the dose planning software. Normalized ratio of counts originating from tumor to surrounding perfused normal liver were calculated for each case (T:N ratio). T:N ratio differences related to etiology of cirrhosis, tumor size, multiplicity of tumors, prior intraarterial therapy, prior ablation therapy, as well as other clinical factors and tumor structural features were compared using Student’s t-test, ANOVA, and linear regression.

**Results:** Prior ablation therapy ($P = .0001$) and multifocal HCC ($P = .03$) were found to be associated with an increased T:N ratio, while larger sized singular HCC ($P = .03$) were associated with lower T:N ratios. Etiology of patient cirrhosis ($P = .98$), Child-Pugh score ($P = .47$), and other patient factors were found to have no significant T:N ratio association.

**Conclusions:** An underlying assumption of partition model dosimetry is a uniform T:N ratio of Y90 invariant to the clinical scenario. Our data suggests that smaller sized HCC, cases of multifocal HCC, and HCC which have been previously treated with ablation therapy preferentially uptake a higher relative quantity of 99mTc-MAA compared to surrounding normal liver as compared to larger, singular HCCs which have not been previously treated. These findings suggest certain types of HCC in certain patients may be successfully treated with lower doses of intraarterial Y90 to achieve similar intratumoral Y90 uptake.

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**Scientific Session 1**

Interventional Oncology I

Monday, March 22, 2021

10:00 AM – 11:00 AM

**Abstract No. 4**

**Accuracy of scout dose Y90 liver biodistribution for personalized treatment planning of Y90 radioembolization of hepatocellular carcinoma: interim analysis of a prospective clinical trial**

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**Purpose:** To evaluate the accuracy of scout dose Yttrium-90 (Y90) resin microspheres versus technetium-99m MAA (Tc99m-MAA) in predicting the therapeutic dose Y90 liver biodistribution for radioembolization (RE) planning in hepatocellular carcinoma (HCC) patients

**Materials and Methods:** In a prospective single-arm clinical trial, patients with HCC undergoing Y90 RE were recruited. Inclusion criteria included unilobar disease with ≤3 lesions with the largest lesion ≤7 cm. Each patient underwent mapping angiography study with Tc99m-MAA and MAA SPECT/CT followed by second mapping study using 15 mCi Y90 resin microspheres and Y90 SPECT/CT and PET/CT. Prospective treatment planning with MAA data was performed using portion model with the goal of >200 Gy to the targeted tumor. Prescribed Y90 activity minus previously administered scout activity was administered 3 days after the mapping studies. Same microcatheter type and position were used for all stages of the study in each patient. Sureplan (MIM Software, Cleveland, OH) was used for all dosimetry analyses. Using paired t-test, the tumor:normal (TNR) calculated by MAA SPECT and scout dose Y90 SPECT and PET were compared to that of therapeutic dose Y90 SPECT and PET.

**Results:** First N = 15 patients treated in the clinical trial are included in this interim analysis. Mean TNR by MAA SPECT was 2.33. Mean TNR by scout dose Yttrium-90 (Y90) resin microspheres versus technetium-99m MAA (Tc99m-MAA) was statistically similar to both scout dose and therapeutic dose Y90 TNRs calculated by SPECT (Ps< 0.001). MAA TNR was statistically similar to both scout dose and therapeutic dose Y90 TNRs calculated by PET ($P = 0.33$ and $P = 0.55$, respectively). Y90 Scout and therapeutic dose TNRs calculated by SPECT were similar ($P = 0.59$) and the same finding was observed for Y90 TNRs calculated by Y90 scout and therapeutic dose PET ($P = 0.74$).

**Conclusions:** Y90 scout dose is an accurate predictor of therapeutic Y90 dose biodistribution in the liver on both SPECT and PET, respectively. On the other hand, Tc99-MAA TNR was significantly greater than both Y90 scout and therapeutic dose TNRs on SPECT, whereas it was statistically similar to that of PET.