AbstractID: 14283 Title: Early Prediction of Outcome in Brain Metastases Patients Based on Vascular Alterations After Radiotherapy: A Prospective Perfusion MRI Study

Purpose: To assess whether alterations in the vascular volume or blood-tumor barrier after whole brain radiotherapy (WBRT) predict for subsequent response or outcome of patients with brain metastases.

Methods/Materials: Twenty one patients receiving WBRT for brain metastases underwent dynamic-contrast enhanced (DCE) magnetic resonance imaging (MRI) before RT, at the end of RT, and one month after the completion of RT. For patients with 1-3 brain metastases, all lesions were analyzed. For patients with more than 3 metastases, the largest 3 lesions were analyzed. Vascular volume and permeability (K^{trans}) were quantified from the DCE MRI. Additionally, the fractional volume of the tumor with blood-tumor barrier opening ($K^{trans} > 0.005\ min^{-1}$) was evaluated. Changes in these parameters during RT were evaluated for association with subsequent volumetric response in each lesion. Additionally, for each patient, changes in these parameters within an index lesion (the largest lesion post-treatment) were evaluated for association with overall survival.

Results: Forty-three lesions were evaluated. At one month following RT, 17 lesions (40%) had decreased in volume. Within neovascularized metastases (lesions with a baseline vascular volume greater than the background gray matter), increases in vascular volume at the completion of RT (compared to pre-treatment) were significantly associated with subsequent tumor growth at 1 month (area under ROC curve = 0.89, $p < 0.05$). Additionally, the index lesions demonstrating an increase in the fractional volume of blood-tumor barrier opening were significantly associated with increased overall survival (median survival of 11.4 vs 5 months, $p < 0.01$).

Conclusion: Our findings suggest that early alterations in the vascular volume and blood-tumor barrier opening may be helpful in selecting which patients should have treatment intensification, via either stereotactic boost or systemic chemotherapy, following completion of whole brain radiotherapy for brain metastases.
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