

AbstractID: 14316 Title: Assessment of Blood-Brain-Barrier (BTB) Permeability Change in Brain Metastases After Whole-Brain Radiation Therapy Using Dynamic Contrast-Enhanced Magnetic Resonance Imaging (DCE-MRI)

Purpose: Our previous study indicates that an increase in the fractional tumor volume of blood-tumor barrier opening (BTB) at the end of whole-brain radiation therapy (WBRT) for brain metastases is associated with better survival. This study is to assess the extent and time of changes in the BTB permeability of brain metastases after WBRT.

Materials and Method: Twenty patients treated with WBRT for metastases to brain participated in a prospective MRI study. Dynamic contrast-enhanced (DCE) MRI was acquired before (pre-RT), at the end of (end-RT), and 1-month after the completion of therapy (1-month). Permeability of BTB was quantified using the transfer constant K^{trans} derived from DCE-MRI. A total of 46 lesions were evaluated for their fractional tumor volumes ($\%V_{\text{open}}$) with BTB opening ($K^{\text{trans}} > 0.005 \text{ min}^{-1}$) pre-RT and subsequent changes at end-RT and 1-month.

Results: All but 3 lesions had greater than 50% of $\%V_{\text{open}}$ pre-RT. Thirteen lesions had $>95\%$ of $\%V_{\text{open}}$ pre-RT (group 1). For the remaining of 33 lesions, 10 had an increase in $\%V_{\text{open}}$ greater than 5% (group 2), 9 were stable (less than $\pm 5\%$ change in $\%V_{\text{open}}$, group 3), and 14 had a decrease greater than 5% (group 4) at 1-month compared to pre-RT. For group 2, the $\%V_{\text{open}}$ values increased by 21% at end-RT and further increased by 31% 1-month from 45% of the pre-RT value; and the K^{trans} values also increased at both time points. For groups 1 and 4, the $\%V_{\text{open}}$ values decreased by 10% and 25% at 1-month from the pre-RT values of 98% and 76%, respectively.

Conclusion: The great extent of BTB opening in brain metastases after irradiation may increase the probability for a drug to across the BTB to reach tumor cells. This information may be useful for choosing candidates and time window for chemotherapy.

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