Clinical Oncology 31 (2019) e121

Contents lists available at ScienceDirect

Clinical Oncology

journal homepage: www.clinicaloncologyonline.net

Letter

Heterogeneity of Magnetic Resonance Imaging Apparent Diffusion Coefficient Signal in Radiation Necrosis

Madam — We read with interest 'Evaluation of response to stereotactic radiosurgery in brain metastases using multiparametric magnetic resonance imaging and a review of the literature' [1]. The authors use cut-off values of apparent diffusion coefficient (ADC) $< 1000 \times 10^{-6}$ mm^2/s, cerebral blood volume ratio > 2.1 and choline:creatine ratio > 1.8 to suggest tumour recurrence over radiation changes.

Given the small number of patients in this study and lack of consensus in the literature, caution is recommended in basing treatment, and particularly surgical intervention, on multiparametric magnetic resonance imaging. Although perfusion studies are validated in a robust manner, results using diffusion-weighted imaging and spectroscopy remain unsatisfactory. This is reflected by a longstanding lack of inclusion of these criteria in guidelines of the Response Assessment in Neuro-Oncology Brain Metastases working group [2].

Diffusion-weighted imaging measures ADC in biological tissues, reflecting mobility of water protons. In radiation necrosis, ADC would be determined by diverse considerations, including cellularity, viscosity, permeability and spacing of diffusion barriers.

We recently assessed an enlarging metastasis after stereotactic radiosurgery, resected on the basis of profoundly low ADC (512×10^{-6} mm^2/s), wherein subsequent histopathology showed radiation necrosis.

Previous studies have shown heterogeneous [3] and low [4] ADC in radiation necrosis. A reason for heterogeneous ADC values in radiation necrosis is microscopic blood products [3]. Also, radiation effects on the fibrinolytic enzyme system contribute to cytotoxic oedema [5]. Finally, low ADC in some radiation necrosis reflects high viscosity from inflammatory cellular composition.

Thus, mechanisms for radiation neurotoxicity are multifactorial and reflected by heterogeneity of ADC. The suggestion of a cut-off ADC to differentiate recurrence from radiation necrosis is met with scepticism. We agree with the authors that ADC measurements in radiated metastases merit further studies with larger cohorts and longer clinical follow-up or histopathological validation.

Conflict of interest

The authors declare no conflict of interest.

D. Sanghvi*, A. Redij*, B. Kulkarni†

* *Department of Radiology, Kokilaben Dhirubhai Ambani Hospital, Mumbai, India*

† *Department of Pathology, Kokilaben Dhirubhai Ambani Hospital, Mumbai, India*

References

[1] Sawlani V, Davies N, Patel M, *et al.* Evaluation of response to stereotactic radiosurgery in brain metastases using multiparametric magnetic resonance imaging and a review of the literature. *Clin Oncol* 2019;31(1):41–49. https://doi.org/10.1016/j.clon.2018.09.003.

[2] Lin NU, Lee EQ, Aoyama H, *et al.* Response Assessment in Neuro-Oncology (RANO) group. Response assessment criteria for brain metastases: proposal from the RANO group. *Lancet Oncol* 2015;16(6):e270–e278. https://doi.org/10.1016/S1470-2045(15)70057-4.

[3] Asao C, Korogi Y, Kitajima M, *et al.* Diffusion-weighted imaging of radiation-induced brain injury for differentiation from tumor recurrence. *AJNR Am J Neuroradiol* 2005;26(6):1455–1460.

[4] Tung GA, Evangelista P, Rogg JM, Duncan III JA. Diffusion-weighted MR imaging of rim-enhancing brain masses: is markedly decreased water diffusion specific for brain abscess? *AJR Am J Roentgenol* 2001;177:709–712. https://doi.org/10.2214/ajr.177.3.1770709.

[5] Kumar AJ, Leeds NE, Fuller GN, *et al.* Malignant gliomas: MR imaging spectrum of radiation therapy- and chemotherapy-induced necrosis of the brain after treatment. *Radiology* 2000;217:377–384. https://doi.org/10.1148/radiology.217.2.r00nv36377.

https://doi.org/10.1016/j.clon.2019.04.005