DSC T2* MR Perfusion Analysis

Summary

Imaging biomarkers, particularly tumor blood volume estimates, have provided additional patient prognostic information (1–6) independent of the histological grade in gliomas and within the high-grade glioma group.

Raw and post-processed image subsets of the TCGA-gliobastoma multiforme (GBM) collection can be used to evaluate the role of tumor blood volume estimated using DSC T2* magnetic resonance (MR) perfusion in GBM. This data can be correlated with information in genomic publications or from the TCGA Data Portal for survival prediction and other genomic and clinical result comparison.

The post-processed studies were generated with nordicICE software (NordicImagingLab AS) using the FDA-approved DSC T2* perfusion module, which corrects for contrast agent leakage from intravascular to extracellular space using the method published by Boxerman, *et al.* (1). Normalized relative cerebral blood volume (rCBV) maps with leakage correction were produced by the software, which normalizes the CBV relative to a globally determined mean value.

All the regions of interest (ROI) were drawn by Rajan Jain and Jayant Narang (Henry Ford Hospital) in consensus on the rCBV maps fused with post-contrast T1-weighted (T1W) images and *fluid attenuated inversion recovery* (FLAIR) images. $rCBV_{mean}$, $rCBV_{max}$, and rCBV of the non-enhancing part of the lesion (NEL) were measured from the rCBV maps and stored in a spreadsheet. To measure rCBV, mean ROIs were drawn on the contrast-enhancing portion of the tumor image (excluding any areas of necrosis and blood vessels) on all slices which contained the tumor to obtain a mean. To measure $rCBV_{max}$, an ROI of 10 x 10 voxels was placed on the hottest-appearing part of the tumor, based on qualitative perfusion maps. An ROI of 10 x 10 voxels was placed on three spots on the non-enhancing FLAIR abnormality within 1 cm of the edge of the enhancing lesion to measure rCBVNEL and obtain a mean.

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Note: Additional References listed at the bottom of this page

Supporting Documentation and Metadata

The following supporting documentation is available for download. This information was updated on 2012-02-27 and includes information relevant to the 55 processed cases in the archive.

- Spreadsheet– contains scaling factors, rCBV values, and scanner info.
- Text files– contain text dumps of DICOM elements for nordicICE perfusion image studies.

Shared Lists

The following 2 links provide an easy way to download only the raw and post-processed image subsets of the TCGA-GBM

collection described in the project summary.

- **TCGA-GBM DSC T2* MR Perfusion**—contains the raw perfusion image studies
- **TCGA-GBM DSC T2* nordicICE**—contains the post-processed nordiceICE perfusion image studies

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Additional Publication Resources

The Collection authors suggest the below will give context to this dataset:

1. Boxerman JL, Schmainda KM, Weisskoff RM. Relative cerebral blood volume maps corrected for contrast agent extravasation significantly correlate with glioma tumor grade, whereas uncorrected maps do not. AJNR Am J Neuroradiol 2006;27(4):859–867. PMC8134002
2. Aronen HJ, Gazit IE, Louis DN, *et al*. Cerebral blood volume maps of gliomas: comparison with tumor grade and histologic findings. Radiology 1994;191(1):41–51. https://doi.org/10.1148/radiology.191.1.8134596
3. Lev MH, Ozsunar Y, Henson JW, *et al*. Glial tumor grading and outcome prediction using dynamic spin-echo MR susceptibility mapping compared with conventional contrast-enhanced MR: confounding effect of elevated rCBV of oligodendrogliomas corrected. AJNR Am J Neuroradiol 2004;25(2):214–221. PMC7974605
4. Law M, Oh S, Babb JS, *et al*. Low-grade gliomas: dynamic susceptibility-weighted contrast-enhanced perfusion MR imaging--prediction of patient clinical response. Radiology 2006;238(2):658–667. https://doi.org/10.1148/radiol.2382042180
5. Law M, Young RJ, Babb JS, *et al*. Gliomas: predicting time to progression or survival with cerebral blood volume measurements at dynamic susceptibility-weighted contrast-enhanced perfusion MR imaging. Radiology 2008;247(2):490–498. https://doi.org/10.1148%2Fradiol.2472070898
6. Bisdas S, Kirkpatrick M, Giglio P, Welsh C, Spampinato MV, Rumboldt Z. Cerebral blood volume measurements by perfusion-weighted MR imaging in gliomas: ready for prime time in predicting short-term outcome and recurrent disease? AJNR Am J Neuroradiol 2009;30(4):681–688. https://doi.org/10.3174/ajnr.a1465
7. Mills SJ, Patankar TA, Haroon HA, Baleriaux D, Swindell R, Jackson A. Do cerebral blood volume and contrast transfer coefficient predict prognosis in human glioma? AJNR Am J Neuroradiol 2006;27(4):853–858. PMC8133992