

# Outcome Prediction in Patients with Glioblastoma by Using Imaging, Clinical, and Genomic Biomarkers: Focus on the Nonenhancing Component of the Tumor

## Description

This manuscript correlates patient survival with morphologic imaging features and hemodynamic parameters obtained from the nonenhancing region (NER) of glioblastoma (GBM), along with clinical and genomic markers. Forty-five patients with GBM underwent baseline imaging with contrast material-enhanced magnetic resonance (MR) imaging and dynamic susceptibility contrast-enhanced T2\*-weighted perfusion MR imaging. Molecular and clinical predictors of survival were obtained. Single and multivariable models of overall survival (OS) and progression-free survival (PFS) were explored with Kaplan-Meier estimates, Cox regression, and random survival forests.

Worsening OS (log-rank test,  $P = .0103$ ) and PFS (log-rank test,  $P = .0223$ ) were associated with increasing relative cerebral blood volume of NER (rCBV NER), which was higher with deep white matter involvement (t test,  $P = .0482$ ) and poor NER margin definition (t test,  $P = .0147$ ). NER crossing the midline was the only morphologic feature of NER associated with poor survival (log-rank test,  $P = .0125$ ). Preoperative Karnofsky performance score (KPS) and resection extent ( $n = 30$ ) were clinically significant OS predictors (log-rank test,  $P = .0176$  and  $P = .0038$ , respectively). No genomic alterations were associated with survival, except patients with high rCBV NER and wild-type epidermal growth factor receptor (EGFR) mutation had significantly poor survival (log-rank test,  $P = .0306$ ; area under the receiver operating characteristic curve = 0.62). Combining resection extent with rCBV NER marginally improved prognostic ability (permutation,  $P = .084$ ). Random forest models of presurgical predictors indicated rCBV NER as the top predictor; also important were KPS, age at diagnosis, and NER crossing the midline. A multivariable model containing rCBV NER, age at diagnosis, and KPS can be used to group patients with more than 1 year of difference in observed median survival (0.49-1.79 years). Conclusion Patients with high rCBV NER and NER crossing the midline and those with high rCBV NER and wild-type EGFR mutation showed poor survival. In multivariable survival models, however, rCBV NER provided unique prognostic information that went above and beyond the assessment of all NER imaging features, as well as clinical and genomic features.

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## Detailed Description

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For more information about the authors' perfusion analysis and the full TCGA-GBM data sets please see the following links:

- [DSC T2\\* MR Perfusion Analysis](#)
- [TCGA-GBM](#)

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Jain R, Poisson LM, Gutman D, Scarpace L, Hwang SN, Holder CA, Wintermark M, Rao A, Colen RR, Kirby J, Freymann J, Jaffe CC, Mikkelsen T, and Flanders A. (2014). Outcome Prediction in Patients with Glioblastoma by Using Imaging, Clinical, and Genomic Biomarkers: Focus on the Nonenhancing Component of the Tumor. The Cancer Imaging Archive. <http://doi.org/10.7937/K9/TCIA.2014.FAB7YRPZ>

#### TCIA Citation

Clark K, Vendt B, Smith K, Freymann J, Kirby J, Koppel P, Moore S, Phillips S, Maffitt D, Pringle M, Tarbox L, Prior F. **The Cancer Imaging Archive (TCIA): Maintaining and Operating a Public Information Repository**, Journal of Digital Imaging, Volume 26, Number 6, December, 2013, pp 1045-1057. ([paper](#))

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Radiology. 2014 Mar 19:131691. [Epub ahead of print] Outcome Prediction in Patients with Glioblastoma by Using Imaging, Clinical, and Genomic Biomarkers: Focus on the Nonenhancing Component of the Tumor. [PMID:24646147](#)

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