Review Curr Oncol Rep. 2023 Jul 20. doi: 10.1007/s11912-023-01440-2. Online ahead of print.

# Disease Assessments in Patients with Glioblastoma

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PMID: 37470973 DOI: 10.1007/s11912-023-01440-2

## Abstract

**Purpose of review:** The neuro-oncology team faces a unique challenge when assessing treatment response in patients diagnosed with glioblastoma. Magnetic resonance imaging (MRI) remains the standard imaging modality for measuring therapeutic response in both clinical practice and clinical trials. However, even for the neuroradiologist, MRI interpretations are not straightforward because of tumor heterogeneity, as evidenced by varying degrees of enhancement, infiltrating tumor patterns, cellular densities, and vasogenic edema. The situation is even more perplexing following therapy since treatment-related changes can mimic viable tumor. Additionally, antiangiogenic therapies can dramatically decrease contrast enhancement giving the false impression of decreasing tumor burden. Over the past few decades, several approaches have emerged to augment and improve visual interpretation of glioblastoma response to therapeutics. Herein, we summarize the state of the art for evaluating the response of glioblastoma to standard therapies and investigational agents as well as challenges and future directions for assessing treatment response in neuro-oncology.

**Recent findings:** Monitoring glioblastoma responses to standard therapy and novel agents has been fraught with many challenges and limitations over the past decade. Excitingly, new promising methods are emerging to help address these challenges. Recently, the Response Assessment in Neuro-Oncology (RANO) working group proposed an updated response criteria (RANO 2.0) for the evaluation of all grades of glial tumors regardless of IDH status or therapies being evaluated. In addition, advanced neuroimaging techniques, such as histogram analysis, parametric response maps, morphometric segmentation, radio pharmacodynamics approaches, and the integrating of amino acid radiotracers in the tumor evaluation algorithm may help resolve equivocal lesion interpretations without operative intervention. Moreover, the introduction of other techniques, such as liquid biopsy and artificial intelligence could complement conventional visual assessment of glioblastoma response to therapies. Neuro-oncology has evolved over the past decade and has achieved significant milestones, including the establishment of new standards of care, emerging therapeutic options, and novel clinical, translational, and basic research. More recently, the integration of histopathology with molecular features for tumor classification has marked an important paradigm shift in brain tumor diagnosis. In a similar manner, treatment response monitoring in neuro-oncology has made considerable progress. While most techniques are still in their inception, there is an emerging body of evidence for clinical application. Further research will be critically important for the development of impactful breakthroughs in this area of the field.

**Keywords:** Artificial intelligence; Bevacizumab; Glioblastoma; Neurocognitive; Pseudoprogression; Radiomics; Response assessment; Seizure.