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# A clinicopathological and molecular analysis of glioblastoma multiforme with long-term survival.

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### Abstract

The median survival time of patients with glioblastoma multiforme (GBM) is 12 months, and only 3-5% of patients survive longer than 3 years. We performed histomorphological and detailed molecular analyses of seven long-term survivors of GBM to identify any prognostic factors that potentially contribute to survival. Morphology and immunohistochemistry for p53, phosphatase and tensin homologue (PTEN) and epidermal growth factor receptor (EGFR) protein expression were investigated. EGFR amplification and 1p/19q deletion were assessed by fluorescent in situ hybridization. The O6-methylguanine-DNA methyltransferase (MGMT) gene methylation status was evaluated by performing methylation-specific polymerase chain reaction assays. All tumors were classical GBMs and no significant oligodendroglial differentiation was noted. The majority showed EGFR amplification (4/7), PTEN protein expression (6/7) and MGMT promoter methylation (5/6). Immunopositivity for p53 was noted in three of seven patients. Deletion of chromosome 1p/19q, either isolated or combined, was not identified in any of the seven patients. All patients were treated by gross total resection followed by radiotherapy; six patients received additional temozolomide treatment. A relatively young age of onset (48 years), with a high MGMT promoter methylation and PTEN protein expression were favorable factors for long-term survival. The presence of EGFR amplification indicates that more than a single factor determines survival in GBM.

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