An extent of resection threshold for newly diagnosed glioblastomas.
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Abstract
Object The value of extent of resection (EOR) in improving survival in patients with glioblastoma multiforme (GBM) remains controversial. Specifically, it is unclear what proportion of contrast-enhancing tumor must be resected for a survival advantage and how much survival improves beyond this threshold. The authors attempt to define these values for the patient with newly diagnosed GBM in the modern neurosurgical era. Methods The authors identified 500 consecutive newly diagnosed patients with supratentorial GBM treated at the University of California, San Francisco between 1997 and 2009. Clinical, radiographic, and outcome parameters were measured for each case, including MR imaging-based volumetric tumor analysis. Results The patients had a median age of 60 years and presented with a median Karnofsky Performance Scale (KPS) score of 80. The mean clinical follow-up period was 15.3 months, and no patient was unaccounted for. All patients underwent resection followed by chemotherapy and radiation therapy. The median postoperative tumor volume was 2.3 cm$^3$, equating to a 96% EOR. The median overall survival was 12.2 months. Using Cox proportional hazards analysis, age, KPS score, and EOR were predictive of survival ($p < 0.0001$). A significant survival advantage was seen with as little as 78% EOR, and stepwise improvement in survival was evident even in the 95%-100% EOR range. A recursive partitioning analysis validated these findings and provided additional risk stratification parameters related to age, EOR, and tumor burden. Conclusions For patients with newly diagnosed GBMs, aggressive EOR equates to improvement in overall survival, even at the highest levels of resection. Interestingly, subtotal resections as low as 78% also correspond to a survival benefit.

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