Recurrent Glioblastoma Treated with Bevacizumab: Contrast-enhanced T1-weighted Subtraction Maps Improve Tumor Delineation and Aid Prediction of Survival in a Multicenter Clinical Trial.

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Abstract

Purpose To compare the capability to aid prediction of clinical outcome measures, including progression-free survival (PFS) and overall survival (OS), between volumetric estimates from contrast material-enhanced (CE) T1-weighted subtraction maps and traditional segmentation in a randomized multicenter clinical trial of recurrent glioblastoma (GBM) patients treated with bevacizumab. Materials and Methods All patients participating in this study signed institutional review board-approved informed consent at their respective institutions prior to enrolling in the multicenter clinical trial. One-hundred sixty patients with recurrent GBM enrolled as part of a HIPAA-compliant, multicenter clinical trial (AVF3708 g, BRAIN trial). Contrast-enhancing tumor volumes and change in volumes as a response to therapy were quantified by using either conventional segmentation or CE T1-weighted subtraction maps created by voxel-by-voxel subtraction of intensity-normalized nonenhanced T1-weighted images from CE T1-weighted images. These volumes were then tested as predictors of PFS and OS by using log-rank univariate analysis, the multivariate Cox proportional hazards regression model, and receiver operating characteristic analysis. Results Use of CE T1-weighted subtraction maps qualitatively improved visualization and improved quantification of tumor volume after bevacizumab treatment. Significant trends between the volume of tumor and change in tumor volume after therapy on CE T1-weighted subtraction maps were found for both PFS and OS (pretreatment volume < 15 cm³, P < .003; posttreatment volume < 7.5 cm³, P < .05; percentage change in volume > 25%, P = .004 for PFS and P = .053 for OS). CE T1-weighted subtraction maps were significantly better at aiding prediction of 6-month PFS and 12-month OS compared with conventional segmentation by using receiver operating characteristic analysis (P < .05). Conclusion Use of CE T1-weighted subtraction maps improved visualization and aided better prediction of patient survival in recurrent GBM treated with bevacizumab compared with conventional segmentation of CE T1-weighted images. ©RSNA, 2013 Clinical trial registration no. NCT00345163 Online supplemental material is available for this article.

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