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Awake surgery for WHO Grade II gliomas within "noneloquent" areas in the left dominant hemisphere: toward a "supratotal" resection.

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Abstract

Object It has been demonstrated that an extensive resection (total or subtotal) may significantly increase the overall survival in patients with WHO Grade II gliomas (low-grade gliomas [LGGs]). Yet, recent data have shown that conventional MR imaging underestimates the spatial extent of LGG, since tumor cells were found up to 20 mm around MR imaging abnormalities. Thus, it was hypothesized that an extended resection with a margin beyond MR imaging-defined abnormalities—a "supratotal" resection—might improve the outcome of LGG. However, because of the frequent location of LGG within "eloquent" brain areas, it is often difficult to achieve such a supratotal resection. This could nevertheless be possible when LGGs involve "noneloquent" areas, even in the left dominant hemisphere. The authors report on their use of awake electrical mapping to tailor the resection according to functional boundaries, that is, to pursue the resection beyond MR imaging-defined abnormalities, until corticosubcortical eloquent structures are encountered. Their aim was to apply this reliable surgical technique to LGGs located not within eloquent areas but distant from eloquent areas, to take a margin around the LGG visible on MR imaging while preserving brain function. Methods Fifteen right-handed patients with a total of 17 tumors underwent resection of WHO Grade II gliomas involving nonfunctional areas within the left dominant hemisphere. In all patients, seizures were the initial manifestation of the tumors. Awake surgery with intraoperative electrostimulation was performed in all cases. The resection was continued until the surgeon reached cortical and subcortical areas crucial for brain function, especially language, as defined by the intrasurgical electrical mapping. The extent of resection was evaluated on postoperative FLAIR-weighted MR images. Results Despite transient neurological worsening in 60% of cases, all patients recovered and returned to a normal life. Seizure control was obtained in all patients with a decrease of antiepileptic drug therapy. Postoperative MR imaging showed that total resection was achieved in all 17 tumors and supratotal resection in 15. The average volume of the postoperative cavity (36.8 cm³) was significantly larger than the mean preoperative tumor volume (26.6 cm³) (p = 0.009). Neuropathological examination confirmed the diagnosis of WHO Grade II glioma in all cases. The mean duration of postoperative follow-up was 35.7 months (range 6-135 months). Only 4 of 15 patients experienced recurrence (without anaplastic transformation); the average time to recurrence in these cases was 38 months; radiotherapy was performed 6 years after the relapse in 1 case; no other patients received any adjuvant treatment. This series was compared with a control group of 29 patients who had "only" complete resection: anaplastic transformation was observed in 7 cases in the control group but not in any case in the series of patients who underwent supracomplete resection (p = 0.037). Furthermore, adjuvant treatment was administered in 10 patients in the control group compared with 1 patient who underwent supracomplete resection (p = 0.043). Conclusions These findings support the usefulness of awake surgery with intraoperative functional (language) mapping with the attempt to perform supratotal resection of LGGs involving noneloquent areas in the left hemisphere. Indeed, the extent of resection was significantly increased in all cases but 2, with no additional permanent deficit and with control of seizures in all patients. The goal of supracomplete resection is currently to delay the anaplastic transformation, even if it does not (yet) enable a cure.

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