# Study of brain connectivity and plasticity applied to surgery of low-grade gliomas in eloquent areas

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Low-grade glioma (LGG) is a brain infiltrative tumor displaying an indolent course initially, but carrying a high risk of anaplastic transformation with death. Surgical removal appears currently the best treatment. However, due to the frequent location within eloquent areas, and because of an interindividual anatomofunctional variability, functional mapping methods are used to taylor the resection according to cortico-subcortical functional boundaries.

We performed preoperative fMRI to plan surgery, then we used intraoperative electrical stimulations during resection, and we performed a postoperative fMRI once the patient had recovered. On the basis of these findings, connectivity and plasticity modelisations could be proposed.

First, preoperatively, fMRI activations showed functional cortical reshaping induced by the slow-growing LGG, explaining the usual lack of significant neurological deficit. Moreover, connectivity graphs also demonstrated changes in comparison to healthy volunteers.

Second, intraoperatively, electrical mapping before resection confirmed the functional reorganization, allowing the LGG removal despite its location in “eloquent areas”. Furthermore, repeated stimulations during resection showed short-term map reshaping, likely due to the unmasking of latent functional redundancies. Anatomofunctional connectivity was also analyzed using subcortical stimulations, to detect the white pathways corresponding to the essential cortical epicenters.

Third, postoperatively, fMRI activations following recovery demonstrated long-term reorganization in comparison to the preoperative images, with possible recruitment of perilesional or remote areas, and controlateral homologous. Postoperative connectivity graphs also showed changes in the functional connections.

Fourth, in cases of re-intervention, stimulations demonstrated a complementary functional reorganization in comparison to the first electrical mapping, consecutive to the previous surgery, allowing sometimes the total resection of LGG without sequelae.

In summary, our data illustrate both short-term and long-term plasticity mechanisms associating *functional cortical reshaping and connectivity changes*, due initially to the LGG growth, then to its surgical resection. Modelisations of such phenomena may help to improve the planning of future surgeries.