

World Neurosurg. 2024 Nov 1:S1878-8750(24)01811-4. doi: 10.1016/j.wneu.2024.10.111.

Online ahead of print.

DTI analysis of the peritumoral zone of diffuse low-grade gliomas in progressing patients

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PMID: 39489335 DOI: [10.1016/j.wneu.2024.10.111](https://doi.org/10.1016/j.wneu.2024.10.111)

Abstract

Background: DLGGs are rare brain tumors transforming to higher grade even with surgery, chemotherapy and radiotherapy. Their preferential infiltration of WM tracts, beyond tumor boundaries on FLAIR, make difficult to plan focal treatment such as surgery, radiotherapy and monitor response to chemotherapy. DTI might reflect this infiltration of WM tracts. The aim of our study is to assess how DTI signal in the peritumoral zone might be modified before FLAIR tumor progression appears at one-year follow-up.

Methods: The study retrospectively enrolled five patients who met inclusion criteria: DTI with 25 directions, T1 and FLAIR at initial imaging; FLAIR at one-year follow-up. Patients with surgery, radiotherapy and chemotherapy completed less than 2 years before initial imaging were excluded. FLAIR tumor progression, named progression mask, was assessed by subtracting tumor masks between initial imaging and one-year follow-up. Initial DTI signal was analyzed within this progression mask and compared with the healthy contralateral side.

Results: Tumor progression was confirmed for the five patients at one year. All patients showed pre-existing DTI signal abnormalities within the progression mask. Mean FA ($p = 0.03$) was lower in the progression mask, whereas MD, AD and RD mean ($p = 0.03$) was higher in the progression mask, compared to healthy side.

Conclusion: This study shows pre-existing DTI signal abnormalities in regions with tumor progression at one year. Such abnormalities could correspond to a tumor infiltration not yet visible on FLAIR. This might be helpful to predict tumor progression and allow to adapt the therapeutic strategy.

Keywords: Diffuse low-grade glioma; tensor diffusion imaging; tumor progression.

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