Early choroid plexus invasion as a risk factor of non-effective postoperative glioblastoma radiotherapy

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Aims and objectives

Glioblastoma nowadays is still one of the most malignant brain tumors with low median overall survival of 14-18 months [1].

Standart treatment is surgery followed by chemoradiation. Evaluation of tumor progression on MRI is often made with RANO Criteria based on measurements of tumor size on contrast-enhanced T1W.

However, with advanced techniques there are options to measure tumor perfusion characteristics with DSC, DCE or ASL techniques, tumor cellularity with DWI, vascular architecture with SWI, TOF and post-contrast T1W, etc. This techniques could possibly provide the useful for prognosis information on earlier followup period that is recommended by RANO [2].

Despite the low overall survival, under the date of some authors about 10% of patients with glioblastoma survive for more than 5 years [3].

Dealing with glioblastoma patients we've found several possible anatomic markers of early disease progression, among which there is a tumor invasion of lateral ventricle choroid plexus.

The aim of this study is to clarify whether invasion of choroid plexus (CP) by glioblastoma during postoperative treatment results early progression of the disease.

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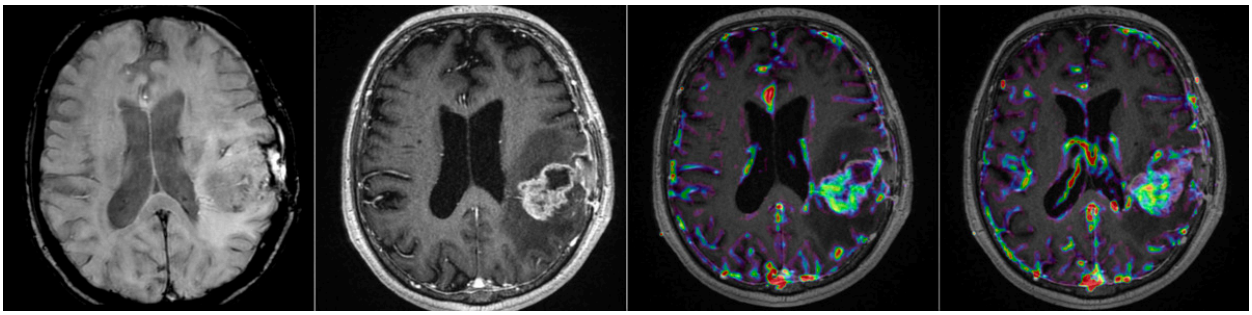

Fig. 2: SWI, CE-T1W and fused CE-T1W/ASL show small drainage veins and feeding arteries with hyperperfusion between tumor and choroid plexus.

Methods and materials

63 patients with postoperative glioblastoma (GB) were examined on 1.5T-MRI with multiparametric protocol before the radiotherapy (RT), after 1 month, 3 months and 6 months after completing radiotherapy course. Protocol included T2W, T1W, FLAIR, DWI, SWI, ASL, DSC-perfusion and contrast-enhanced 3DT1W.

Invasion of CP was concluded by detection of feeding arteries and drainage veins on SWI and contrast-enhanced T1W as well as hyperperfusion in the region of interest by ASL and DSC perfusion methods. Period of 6 months after radiation or chemoradiation treatment was selected as a reference assessment line.

Kendall tau-b coefficient and cross tabulation were used for statistical analysis.

Results

Among 63 patients 42 (66.7%) showed progressive disease and 21 (33.3%) were stable or showed partial response in 6-months period after competing chemoradiation. Data optained within 1 month and 3 months after postoperative treatment showed similar results.

Patients with invaded CP showed progression after therapy in 80.8% cases while patients without invasion of CP - in 56.6%. The sensitivity and specificity of method were 0.50 and 0.76, but the positive predictive value showed 80.8% (p=0.033).

Due to high arterial input and venous drainage of invaded choroid vessels the standard postoperative therapy of partial resected glioblastomas seems ineffective in 80.8% of observed patients.

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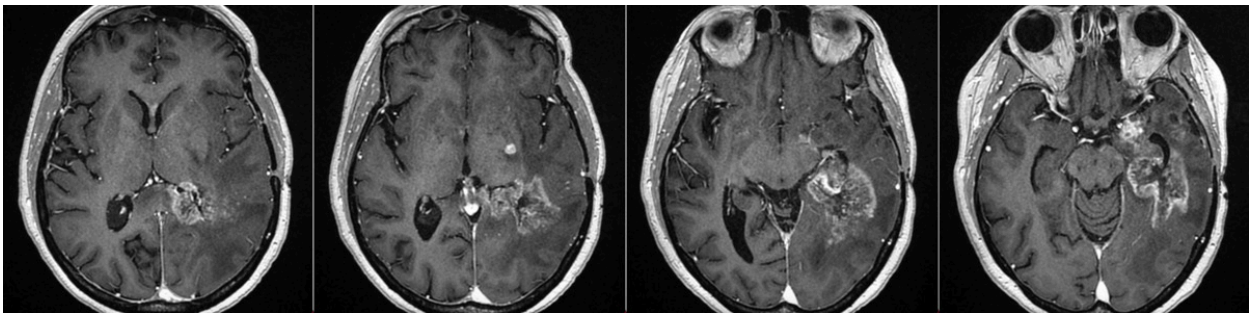

Fig. 3: CE-T1W scans clearly show left lateral ventricle and choroid plexus infiltration. Examination before chemoradiation.

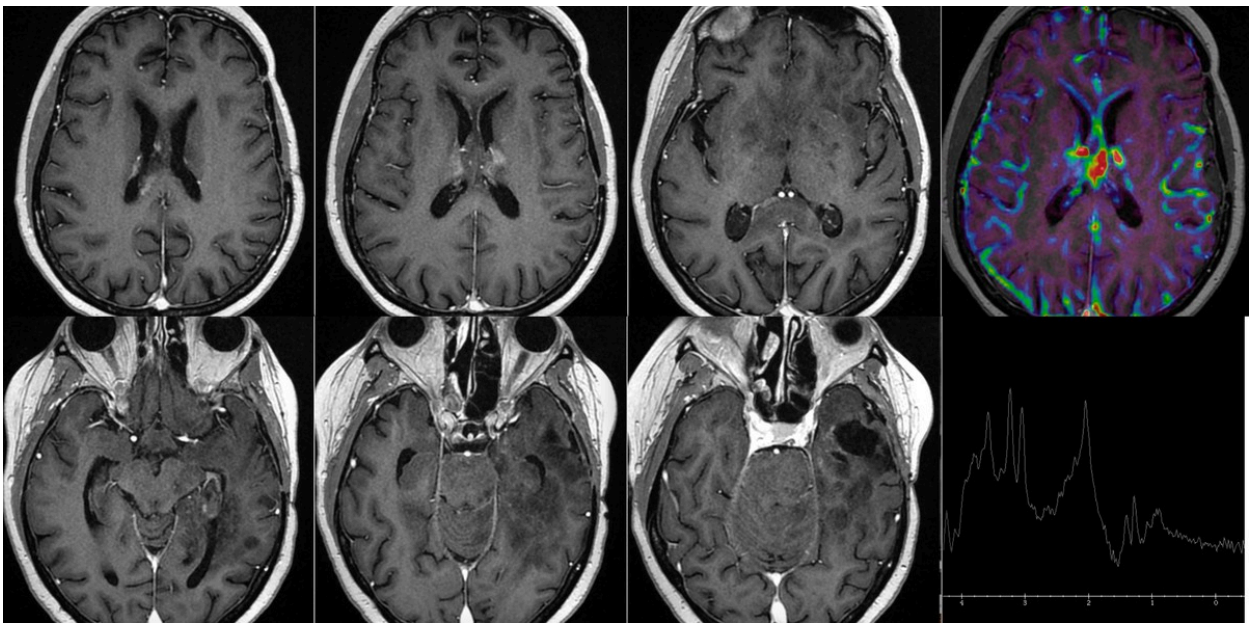

Fig. 4: Examination after chemoradiation (same patient as in Fig.3) shows progression with prominent ependymal growth. Single-voxel spectroscopy prooves low-grade tumor infiltration in non-enhancing areas (mI/Cr>0.75). Note the areas of hyperperfusion suggestive of high-grade infiltration and treatment effect insufficiency.

Conclusion

With achieved data we consider that invasion of CP by GB could be named as one of the risk factor of early GB progression and expect that possible additional antiangiogenic chemotherapy or other treatment options could be selected to improve the treatment results.

Therefore, further studies are needed to clarify that point.

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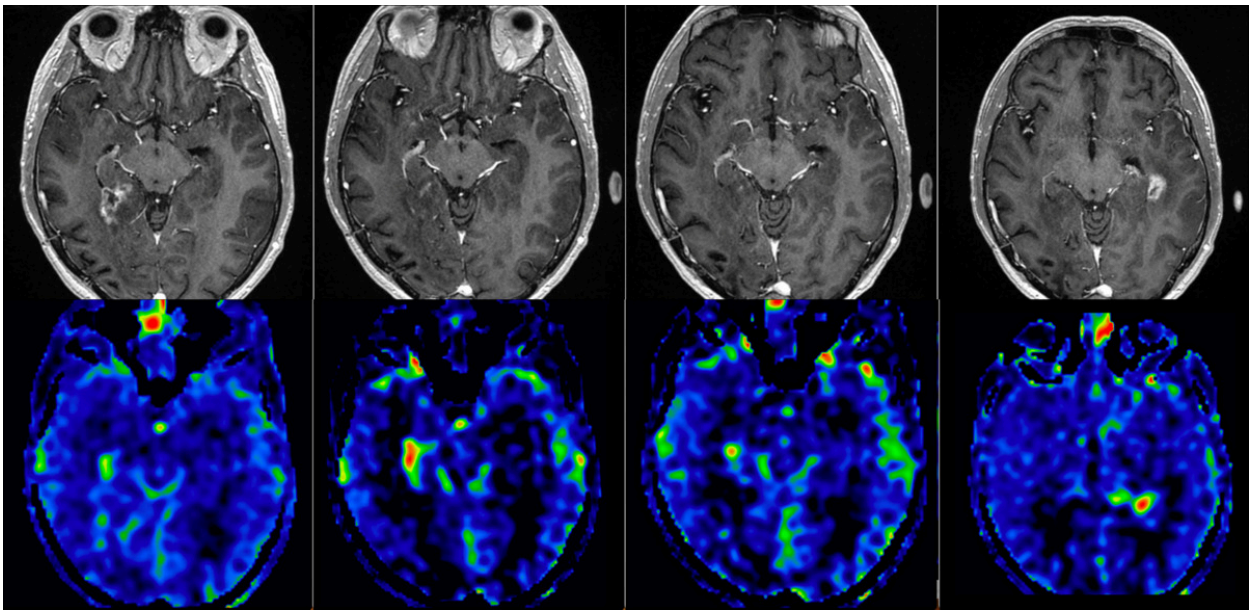

Fig. 1: Contrast-Enhanced T1W and ASL CBF in Patient with post-operative Glioblastoma before Radiotherapy (1st column), +1 month (2nd column), +3 months (3rd column), +6 months (4th column) after 60 Gy Rtx. Note the tumor progression in 6 months with new high-grade mass on the opposite site.

References

1. Stupp R, Hegi ME, Mason WP et al (2009) Effects of radiotherapy with concomitant and adjuvant temozolomide versus radiotherapy alone on survival in glioblastoma in a randomised phase III study: 5-year analysis of the EORTC-NCIC trial. Lancet Oncol 10(5): 459-466

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