

Multiparametric characterization of Glioblastomas

Advisors:

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Objectives of the project:

To quantitatively analyse multiparametric volumetric ultrasound data characterizing glioblastoma development in a mouse model

State of the art & rationale:

Glioblastomas (GBMs) are one of the deadliest forms of brain cancer, with aggressive tumors which are very difficult to treat. Current patient management relies on surgical resection, which is highly risky because of the strong vascularization of these tumors. Understanding GBM structure and vascular development would help surgeons enormously in safely resecting those tumors, thereby improving patient life expectancy.

In this context, we have conducted a preclinical study on mice bearing GBMs, which were imaged longitudinally with several ultrasound imaging techniques assessing the tumor vasculature, rigidity and tissue structure in 3D. This project aims to provide in depth quantitative analysis of the multiparametric volumetric data obtained, to identify markers of GBM progression or relapse based on vascular, rigidity and tissue structure maps.

Methods and tools: A Matlab pipeline of biomarker extraction will be used to extract quantitative information from each map. Statistical analysis will be applied to compare ultrasound imaging data to data provided by histological analysis of the same samples.

Main tasks:

- Extract biomarkers of vascular abnormality, rigidity and tissue structure from the available data
- Correlate the imaging markers to histological information obtained after tumor resection
- Use statistical analysis to identify markers of tumor progression
- Identify biomarkers of GBM vs healthy tissue

Anticipated outcomes and potentials: The trainee will be able to tackle a unique dataset rich in information, with strong implications for GBM patients. The results of the quantitative analysis will be published in a scientific journal.

Role of the student: The student will be responsible for organizing the data, applying and verifying the quantitative analysis, finding correlations with histological data, as well as writing up the results. He/She will be part of a dynamic team including a neurosurgeon and a PhD student, who will be assisting in the data analysis.

Bibliography:

- [1] C. Errico *et al.*, « Ultrafast ultrasound localization microscopy for deep super-resolution vascular imaging », *Nature*, vol. 527, n° 7579, p. 499-502, nov. 2015, doi: 10.1038/nature16066.
- [2] X. Chen, M. R. Lowerison, Z. Dong, A. Han, et P. Song, « Deep Learning-Based Microbubble Localization for Ultrasound Localization Microscopy », *IEEE Trans. Ultrason., Ferroelect., Freq. Contr.*, vol. 69, n° 4, p. 1312-1325, avr. 2022, doi: 10.1109/TUFFC.2022.3152225.

How to apply:

Please send your CV and cover letter to beatrice.walker@inserm.fr