Post-doc offer:

Analysis of radiological features to better define the therapeutic response of primary brain lymphomas

U1288 Inserm, Institut Curie
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Background

Assessing therapeutic response is a major challenge in primary central nervous system lymphoma (PCNSL). Around half of patients in complete remission, as assessed by current response criteria based on gadolinium uptake on magnetic resonance images (MRI), relapse. Today, age is the only factor taken into account in the choice of post-induction treatment, whose options (surveillance, encephalic radiotherapy, intensive chemotherapy with autologous stem cell transplantation) differ greatly in terms of results and toxicity. Treatment intensity cannot yet be adjusted to therapeutic response, as has been well validated in aggressive systemic lymphomas, due to the absence of sufficiently robust response criteria in PCNSL.

Objectives

The aim of this project is to improve PCNSL response criteria by assessing the predictive value of magnetic resonance imaging (MRI) biomarkers, which can be combined with biological biomarkers (interleukin 10 levels in cerebrospinal fluid and circulating tumor DNA).

Methods

A multicenter cohort of 90 patients will be studied, representing a large cohort for this rare disease. This cohort was acquired as part of the LOC-R01 phase IB/II prospective clinical trial (NCT04446962). Each patient will have images corresponding to the MR following sequences: T1-weighted without and with Gadolinium, FLAIR, perfusion, diffusion and spectroscopy. All these sequences were acquired at diagnosis (i.e. before treatment), after two cycles of chemoimmunotherapy (induction treatment), and at the end of induction treatment (or at progression during induction treatment). This longitudinal imaging will enable the implementation of delta-radiomics techniques, involving the comparison of features extracted from images acquired at different times.

The laboratory has significant experience in the semi-supervised segmentation of tumors seen on MRI (1) and in the pre-processing of MRI images required before reliable radiomic features can be extracted (2,3). Analysis pipelines are already available in the laboratory and can be adapted.

In addition, the construction of radiomic models from multimodal MRI images is frequently hampered by missing data, as not all sequences are available for every patient. To this end, we have already developed a solution that makes it possible to exploit all patient data, even in the presence of incomplete data (4).

For the post-doctoral fellow, the aim will be to build on the existing building blocks in the laboratory and his/her experience in image analysis and data science, in order to design the most effective radiomic model for predicting progression-free survival (continuous or at 2 years). Original developments are particularly expected to integrate the longitudinal dimension into the models. The proposed model could be combined with biological biomarkers, in collaboration with the Institut Curie's biostatistics team (Professor Xavier Paoletti).

Scientific environment

The Laboratoire d'Imagerie Translationnelle en Oncologie (LITO) specializes in the production and analysis of medical images, in particular metabolic and functional images (PET and MRI). It is a broadly multidisciplinary team of some forty physicists, engineers, radiologists, nuclear physicians, biologists, oncologists, doctoral students and post-doctoral fellows. Based at the Institut Curie

Research Center and working closely with the Institut Curie Hospital, it benefits from an environment that is particularly well suited to projects involving the advanced analysis of medical images using state-of-the-art radiomics and artificial intelligence techniques.

Financial terms and conditions

Funding will be provided by the DEFI-LOC contract, and the employer will be the Institut Curie Research Center, for a 12-month fixed-term contract. The salary will depend on the candidate's experience. This contract may be extended.

Research valorization objectives: dissemination, publication and confidentiality, intellectual property rights, etc.

The post-doc will have the opportunity to present his/her work at national and international conferences in the fields of medical imaging (RSNA), oncology and hematology (SNMMI meeting, EANM Conference, ASH), and data science (eg, MICCAI, ICML). He or she will publish results in international peer-reviewed journals.

Skills required

- MRI, radiomics, image analysis
- Statistics, machine learning
- Programming skills

Contact

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References

1. Rahimpour M, Saint Martin MJ, Frouin F, Akl P, Orlhac F, Koole M, Malhaire C. Visual ensemble selection of deep convolutional neural networks for 3D segmentation of breast tumors on dynamic contrast enhanced MRI. Eur Radiol. 2023 Feb;33(2):959-969.
2. Goya-Outi J, Orlhac F, Calmon R, Alentorn A, Nioche C, Philippe C, Puget S, Boddaert N, Buvat I, Grill J, Frouin V, Frouin F. Computation of reliable textural indices from multimodal brain MRI: suggestions based on a study of patients with diffuse intrinsic pontine glioma. Phys Med Biol. 2018 May 10;63(10):105003.
3. Saint Martin MJ, Orlhac F, Akl P, Khalid F, Nioche C, Buvat I, Malhaire C, Frouin F. A radiomics pipeline dedicated to Breast MRI: validation on a multi-scanner phantom study. MAGMA. 2021 Jun;34(3):355-366.
4. Khalid F, Goya-Outi J, Escobar T, Dangouloff-Ros V, Grigis A, Philippe C, Boddaert N, Grill J, Frouin V, Frouin F. Multimodal MRI radiomic models to predict genomic mutations in diffuse intrinsic pontine glioma with missing imaging modalities. Front Med (Lausanne). 2023 Feb 23;10:1071447.