CONFERENCE

Institut d'Imagerie Biomédicale
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(SHFJ)

Biological parameter estimation for longitudinal imaging in the rodent brain

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Résumé

The presentation will outline the work of my PhD, Biological parameter estimation for longitudinal imaging in the rodent brain. Pre-clinical PET imaging is useful for investigating animal models of disease, and using longitudinal imaging studies, it is possible to follow evolution toward pathology and response to treatment. This work aimed to develop, explore and validate parameter estimation methods for longitudinal imaging studies in pre-clinical PET of the rodent brain. Investigations were undertaken using extensive kinetic modelling techniques and simulation based approaches.
Two biological targets were investigated, firstly, the D2 dopamine system with 11C-Raclopride in the mouse. Data from partial saturation experiments in the mouse were obtained and binding parameters (receptor concentration Bavail and affinity 1/appKD) were estimated with a data driven approach. This approach uses the dynamic equilibrium state of the system to guide which time points from the PET scan are included in the calculation of the parameters. The parameter estimation technique was thoroughly validated for a range of experimental conditions and simulated disease states. Then the image processing pipeline was fully investigated and optimised to achieve the most accurate parameter estimates and robust statistical detection of changes in parameters. The second biological target investigated was the translocator protein (TSPO), useful for PET imaging as an indicator of neuroinflammation. Two TSPO radioligands were compared, 18F-PBR111 and 18F-PBR102, in a rat model of neurinflammation. The binding parameters were estimated using simplified modelling (SRTM) as well as two tissue compartmental modelling with AIF to validate the simplified method. The techniques developed and validated will reliably estimate stable and accurate kinetic parameters, create parametric maps, and be able to detect small changes in binding parameters locally within the brain.