Identification of biomarkers for distal perfusion following an ischaemic event

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1. Abstract

Ischaemic stroke (IS) causes obstruction of the vessels in the brain and limits the amount of blood that perfuses the regions downstream the occlusion [1]. Collateral blood vessels such as the leptomeningeal anastomoses (LMAs) act as alternative pathways for the blood and allow perfusion of distal tissues [2]. LMAs of good quality are associated to better outcomes after IS. The evaluation of distal perfusion due to LMAs is currently not possible experimentally using non-invasive techniques but can be performed with *in silico* modelling. We present here a mixed mechanistic-statistical computational pipeline for the identification of biomarkers for distal perfusion. The mechanistic part relies extensively on HPC systems for the generation of a large virtual population of stroke patients and consequent simulations of intracranial blood flow, while the statistical part employs Gaussian process emulators and Sobol's sensitivity analysis [3] for the analysis of arterial blood velocities and the biomarker identification. Results show that with this methodology it is possible to quantify the level of distal perfusion, and the effect that the uncertainty on vessel radii has on the estimate of the distal perfusion.

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