McGill University - Imperial College London Student Exchange
Training opportunity within the Juncker Laboratory at McGill University

Cerebral microdialysis is used in patients suffering from severe traumatic brain injury and other pathologies requiring neurosurgery, as part of multi-modal monitoring in the intensive care unit. The small catheter is implanted at the time of surgery and is perfused with artificial cerebrospinal fluid (CSF) to collect small molecules (glucose, glutamate, lactate, pyruvate, glycerol) present in the extracellular space of the brain tissue, also called interstitial fluid. Catheters with a higher size cut-off (100 kDa) can be used to also sample proteins produced by neurons and different types of glia.

One problem often encountered when using cerebral microdialysis is the loss of perfusion fluid to the brain tissue because of the mismatch in tonicity between the artificial CSF and brain interstitial fluid. To counter fluid loss, a high concentration of human serum albumin is often added to the artificial CSF perfusion fluid However, serum albumin has a mass of 67 kDA and it is thus expected that a significant amount crosses the membrane, although no experimental characterization has been reported to date. Yet serum albumin is known to have an adverse effect on astrocytes and therefore may not be a suitable additive in cerebral microdialysis.

The overall goal of this project is to evaluate three different additives to the perfusion fluid to find which one is the safest for patients while allowing us to make several measurements. The additives are serum albumin and two clinical grade types of dextran, an inert sugar polymer with medium and high molecular weight ranges, respectively.

This project has 3 specific goals:
Aim 1: Measure the amount of additives that cross the membrane of a cerebral microdialysis catheter in an *in vitro* setup.
Aim 2: Measure the fluid recovery of additives at different flow rates.
Aim 3: Measure the effect of additives on the recovery of small molecules and a panel of 50 different proteins at different flow rates, using pooled normal human lumbar CSF.

At the end of the project, the recommended additive will be tested *in vivo* on patients treated at the Montreal General Hospital (level 3 trauma center in Quebec) who receive a cerebral microdialysis catheter, and the performance evaluated in a real life context. We expect that the use of a new additive in cerebral microdialysis perfusion fluid will improve the technique and allow us to reliably measure small molecules and proteins in patient brain tissue.

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