Dear Sir or Madam,

Attached you find our most recent findings on limitations of traditional models for cerebral blood flow (CBF) estimation. We are showing that for high image resolution, traditional models for CBF estimation (deconvolution and maximum slope) will overestimate perfusion.

Specifically, we have developed and implemented a novel PDE model for both blood flow and indicator dilution in the capillary system. We show both analytically and experimentally that it can be regarded as a coupled set of traditional one-compartment models. We proceed to discuss notions of perfusion in coupled systems and show analytically that traditional models will overestimate perfusion if they are applied to only parts of the system.

These results are demonstrated experimentally by using traditional models to recover CBF on multiple discretization of the simulated patch. Here we find accurate CBF estimation, if the traditional models are applied to the full patch but overestimation of CBF, if they are applied to only parts of the patch. Evidence of real patient data is provided, which indicates that this effect might also be found on coarse scale in real life applications.

We conclude by proposing to take this effect into consideration when evaluating clinical perfusion data, where coupling is expected. For future developments we propose larger concentration on continuous models of perfusion.

A preliminary version of this work has been submitted as an abstract, not as a proceedings paper, to the ESMRMB 2016.

Best regards

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