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Modelling Direct Brain Cooling for Acute Ischaemic Stroke with the Vascular-Porous Model[1] LUKE FULFORD, Institute for Multiscale Thermofluids, School of Engineering, University of Edinburgh, IAN MARSHALL, PETER ANDREWS, Centre for Clinical Brain Sciences, University of Edinburgh, PRASHANT VALLURI, Institute for Multiscale Thermofluids, School of Engineering, University of Edinburgh — Ischaemic stroke is a major cause of death and disability in the world, occurring when a blockage forms in an artery supplying the brain, preventing blood from accessing part of the brain and causing a cascade of events that ultimately cause the death of tissue in the ischaemic region. Reducing the temperature of this tissue has been shown to be beneficial in increasing the treatment window and improving outcomes. Previous modelling studies with vastly idealised geometry have highlighted difficulties in reducing temperatures within the brain using non-invasive means. However by using a model with 1-dimentional vasculature embedded in a 3-dimentional porous tissue, the geometry of the brain and the ischaemic region can be accurately captured. In this work, we simulate a stroke by obstructing a selected vessel in the arterial tree, allowing for varying degrees of severity. By seeking solutions to the mass, momentum and energy equations, we demonstrate that cooling via the scalp has the potential to provide a useful reduction, around 0.5°C, in temperature within the affected area of the brain. The degree of cooling achievable is dependent on the location of the stroke.

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