

Project description

Development of an optimised non-invasive MRI method to measure renal perfusion in patients with impaired renal function

Summary:

The main aim of this project is to develop an accurate and robust Magnetic Resonance Imaging (MRI) method for measuring blood flow (perfusion) in the kidney. We will use the arterial spin labelling (ASL) approach, in which endogenous blood water is magnetically labelled in the aorta and can therefore act as a kinetic tracer for blood flow in the kidney. An advantage of ASL methods is that they are entirely non-invasive and require no injection of contrast agent, compared to conventional methods such as scintigraphy or positron emission tomography (PET) which involve the administration of radionuclides. This makes ASL particularly suitable for the paediatric population, where it is important to make the experience of undergoing an imaging scan as tolerable and safe as possible. While ASL is becoming a standard technique for mapping blood flow in the brain, its application to renal perfusion has encountered various technical difficulties, some of which have been explored in our recently completed research. This project aims to build on that research and to develop a robust and reliable method to measure renal perfusion. Specifically, we will apply advanced motion correction techniques to eliminate the detrimental effects of movement during the scan, thereby maintaining image resolution and enabling accurate analysis of the images on a pixel-by-pixel basis. In combination with this, we will develop optimised background suppression schemes, which are crucial for maximising measurement precision but must be adapted to ensure the effectiveness of motion correction algorithms. We will investigate the appropriateness of current theoretical models used to quantify perfusion, and develop the best combination of ASL acquisition and image post-processing for applications to the kidney. These optimised methods will then be applied to cases of acute and chronic renal insufficiency to aid diagnosis and monitor the efficacy of therapeutic interventions in children and adults.

The Team:

Dr D Thomas will be the main supervisor with Prof. I Gordon as a secondary supervisor. This work will be incorporated into the current research team that consists of Prof X Golay, Drs C Clark, M King, P Hales and M Cutajar. The work will be carried out mainly in the Imaging and Biophysics unit at UCL ICH who work closely with the Institute of Neurology and the Department of Computer Science at UCL.