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"Hybrid PET/MRI imaging of joint stiffness in total knee arthroplasty"

Total knee replacement (TKR) is a common and generally successful treatment for osteoarthritis (OA) of the knee joint. Unfortunately, some patients develop joint stiffness after undergoing TKR which limits their ability to flex their knee and prevents them from going about activities of daily living. Patients treated for joint stiffness after TKR have poorer outcomes than other TKR patients. Inside the joint, stiffness is caused by "fibrosis" – thickening and stiffening of the tissue that lines the inside of the knee (synovium). It is not known what causes synovial fibrosis in OA but in other diseases, fibrosis is associated with long-term inflammation. In particular, immune cells called macrophages cause fibrosis when they are chronically activated. If over-active macrophages are causing joint stiffness in TKR patients, this could be treated with existing drugs that reduce macrophage activity. This has not been studied because measuring macrophage activity in the knee requires invasive tissue sampling from a biopsy or an operation. We believe that a type of medical imaging known as Positron Emission Tomography (PET) could be used to see and measure macrophage activity within the knee joint non-invasively. A chemical known as a "tracer" is injected into the bloodstream and attaches to activated macrophages anywhere in the body. This tracer is seen by PET imaging. At the same time, using the same imaging machine, Magnetic Resonance Imaging (MRI) of the knee is taken to view the joint anatomy, allowing us to determine the location of PET tracer activity. Our hypothesis is that measuring tracer activity will allow us to correlate the amount of joint stiffness to the level of macrophage activity in the joint tissue. The goal of this exploratory study is to perform PET/MRI exams of subjects undergoing TKR who have no signs of knee stiffness and subjects who underwent TKR and now have joint stiffness and need to repeat the operation. We will compare both PET tracer activity and direct tissue measurements of macrophage activity between these two groups to show that this technique is valid for use in OA patients. If we determine that joint stiffness is associated with macrophage activity, this could lead to clinical trials testing new drugs to prevent and treat joint stiffness by moderating macrophage activity in the joint.