Magnetic resonance imaging (MRI) Of Tissue Fibrosis without Contrast Agent

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Overview

Cardiac fibrosis is a scarring event in the cardiac muscle that causes abnormalities in cardiac function and significantly increases the risk of sudden cardiac death. Although a large proportion of the western population is at high risk, early detection is usually not applicable by the currently available imaging methods. Prof. Michal Neeman and her team developed a new magnetic resonance imaging (MRI) method to detect tissue fibrosis with increased sensitivity and without administering a contrast agent.

The Need

Myocardial fibrosis is associated with worsening ventricular systolic function, abnormal cardiac remodeling, and increased ventricular stiffness, significantly increasing the risk of adverse cardiac outcomes. Hypertension and diabetes elicit fibrotic processes in the heart, placing a high percentage of the western world population at risk, yet the early identification

of fibrotic development in high-risk patients is hindered by a lack of adequate fibrosis imaging modalities. This, in turn, leads to increased morbidity and additional financial burden to health care services. The current standard method to assess myocardial fibrosis employs the usage of magnetic resonance imaging (MRI) coupled with intravenous infusion of Gadolinium contrast agent. However, this method suffers from considerable drawbacks, including reduced sensitivity (diagnosing only advanced stages of disease), lengthy scan times and toxicity of the contrast agent, which excludes a significant subset of patient populations from diagnosis. Thus, the capacity to diagnose myocardial fibrosis in its early stages would allow successful therapeutic intervention and may also create a platform for the non-invasive study of fibrotic development, thereby facilitating the design of targeted therapies.

The Solution

Prof. Michal Neeman and her team developed a novel cardiovascular magnetic resonance method with enhanced sensitivity without the need for contrast agent administration.

Technology Essence

Prof. Michal Neeman and her team developed a novel approach for detecting myocardial fibrosis using magnetization transfer contrast (MCT) MRI cardiac imaging technology. The method was tested in vivo on animal models of heart failure and proved highly sensitive for detecting scar tissue formation and monitoring fibrotic development. One prominent advantage of the present technology over current cardiac imaging modalities is that it eliminates the requirement for extrinsic contrast agents, thereby circumventing potential adverse toxic side effects.

Applications and Advantages

Applications

- Detection of cardiac fibrosis due to various pathologies, including hypertension, diabetes, and heart failure
- Detecting fibrotic tissues in a broad range of disorders, including cancer, renal fibrosis, and pathologies related to skeletal muscles
- A platform for the clinical study of targeted therapies that may prevent or arrest fibrotic diseases
- Monitoring the efficacy of treatment tailored to target fibrotic tissue development

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Advantages

- The method relies on magnetization transfer to provide contrast and therefore obviates the need for any extrinsic, toxic contrast agent such as Gadolinium.
- Improved sensitivity over current contrast agent-based cardiac MRI methods
- The method can be readily applied to existing MRI clinical imaging systems

Patent Status

USA Granted: 9,492,100