Docket #: S15-257

Dynamic-Contrast-Enhanced Magnetic Resonance Imaging with Flow Encoding

Dynamic-contrast-enhanced magnetic resonance imaging (DCE-MRI) provides a characterization of blood flow through vessels and tissues. An equally important scan is cardiac-resolved volumetric phase-contrast MRI (4D flow) that enables blood flow quantification, functional analysis, and anatomical assessment. The acquisitions of these two scans are conventionally performed separately. However, the information from the scans are related and can be better integrated through our invention: a single simple-to-execute sequence that combines DCE with 4D flow. With 3D spatial dimension, 1D cardiac-phase dimension, 1D DCE phases dimension, and flow quantification, the invention is a 5D flow technique.

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Applications

- For a comprehensive cardiopulmonary exam, the 4D flow + DCE sequence enables blood flow quantification in the cardiovascular system, cardiac function, and cardiac anatomy along with pulmonary perfusion and ventilation.
- For a comprehensive adult cardiac exam, the 4D flow + DCE sequence provides blood flow, cardiac function, and cardiac anatomy assessment along with myocardial perfusion and delayed enhancement.
- For body imaging, the 4D flow + DCE sequence characterizes contrast-enhancement dynamics in tissue to depict tumors and lesions along with blood flow quantification hrough arteries and vessels.
- For the 4D flow post-processing analysis, the 4D flow + DCE sequence allows for improved analysis through highlighting the blood flow of different contrast-enhancement phases. For example, the arterial flow can be highlighted (and

then quantified) by using the arterial DCE phases.
- For the DCE post-processing analysis, the 4D flow + DCE sequence allows for the enhancement of the analysis through incorporating the velocity vector fields. For example, the velocity vector fields can be used to more accurately segment vessels and tissues for analysis.

Advantages

- •An integrated technique is simple to prescribe and execute. Only a single volume that encompasses the area of interest needs to be specified.
- The overall MRI exam duration can be reduced since the integrated sequence enables higher scan reduction factors.
- A more accurate reconstruction for contrast-enhanced 4D flow can be performed by resolving the contrast dynamics in the reconstruction.
- No image registration is needed to integrate the DCE reconstruction with the 4D flow reconstruction.
- No image registration is needed to integrate the DCE post-processing analysis with the 4D flow post-processing analysis.

Patents

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