Universität Basel

Research Project

Development and Application of Rapid Conventional and Unconventional Quantitative Magnetic Resonance Imaging

Third-party funded project

Project title Development and Application of Rapid Conventional and Unconventional Quantitative Magnetic Resonance Imaging
Principal Investigator(s) Bieri, Oliver ;
Organisation / Research unit
Bereich Querschnittsfächer (Klinik) / Radiologische Physik (Bieri)
Department
Project start 01.12.2018
Probable end 30.11.2022
Status Completed

The magnetic resonance (MR) signal can be sensitized to a large variety of tissue parameters, as reflected by a vast range of dedicated clinical MR pulse sequences designed to generate contrast even for very subtle tissue alterations with high specificity and sensitivity. Such MR images can be acquired reasonably fast, but their contrast is a non-trivial weighting of various intrinsic and extrinsic parameters and thus not a direct measure for a specific tissue property. As a result, pathological alterations are not identified from a measurable, objective change in tissue properties but rely on a subjective reading of contrast differences on a physically meaningless scale that is affected not only by various random factors but also by instrumentation. Quantification of the MR signal in terms of the underlying biochemical and biophysical tissue parameters is, therefore, generally thought to be the key to MR methodology to push conventional MRI beyond its current limits. It is thus not surprising that the prospect to perform MRI in the tradition of scientific instrumentation has attracted considerable interest in the MR scientific community ever since. Especially, the continuous improvement and progress in scanner hardware and reliability has not only facilitated quantification, but also stimulated the development of a wide variety of methods for the extraction different of biophysical and biochemical parameters. Noteworthy, although quantitative MRI dates back to the early 1970s, its research and development is not only ongoing but performed world-wide with increased interest and effort.

Unfortunately, MR-based tissue quantification is typically a very time-consuming process and can be biased by numerous factors. It is thus not surprising that over the years and even for the most fundamental MR tissue parameters, such as tissue relaxation, a whole ‘buffet’ of MR methods has been proposed to tackle the ‘reliable quantification in reasonable time’ problem for a successful translation and application in the clinics. Only recently, the extraction of MR tissue quantities has become an even more important paramount goal since artificial intelligence and machine learning has entered the field of MRI relying on the availability of large amounts of standardized and comparable, such as quantitative, MRI data.

We have more than a decade of experience in the development and translation of new quantitative MRI methods to the clinical setting. Recent developments, such as spiral readouts and configuration-based imaging methods have shown good prospects and high potential towards a ‘reliable quantification in reasonable time’ for a wide range of tissue parameters. In this research proposal, we further elaborate and extend our recent methodological achievements in a consequent and innovative manner to develop reliable tissue biomarkers for the detection of widespread pathophysiologic processes, as well as subtle and diffuse tissue alterations with high specificity and sensitivity.

Financed by
Swiss National Science Foundation (SNSF)

Add publication

Add documents

Specify cooperation partners