If the MOLLI sequence was unreliable owing to spatial variations in B1+ (the RF excitation field) or B0 (the uniformity of the static magnetic field).

In these situations, we would want the information of the cT1 map but would not be able to enable it using the conventional MOLLI based approach.

Summary

According to an aspect of the present disclosure, there is provided a method of analysing MRI images comprising acquiring at least first medical MR image, and a second medical MR image, of a subject at the same nominal magnetic field strength; analysing the first and second images to determine a wT1 map from the first and second MR images; applying a field strength correction based on modification of the nominal magnetic field strength used for the first and second MR image acquisitions and an iron correction to correct for differences in the iron concentration from a normal level using a T2* map, to the wT1 map from the first and second images to generate a corrected wT1 map; using the corrected wT1 map to determine simulated signals for a subject with normal iron levels, and fitting the simulated signals to determine a standard cT1 image for the subject.

Preferably, the inversion time of the first MR image is shorter than the inversion time of the second MR image. Further preferably the time between the acquisition of the first and second medical images is between 0.1-15 seconds. In a further preferred example the time between the acquisition of the first and second images is between 0.1-3 seconds.

In an example of the disclosure the determination of the wT1 map from the first and second MR images uses a forward Bloch simulation. Preferably, the forward Bloch simulation has inputs comprising one of more of PDFF value, T2 value, wT1 value, a pulse sequence for the scanner used to acquire the images.

In a preferred example of the disclosure, the analysis of the first and second MR images results in a composite image. Preferably, the wT1 map is determined for the composite image.

In this example of the disclosure the composite MR image is determined from the first and second images using the following equation: $S_C = real(S_A \times S_B^{\dagger})/(abs(S_A^2) + abs(S_B^2))$ Where $\dagger$ denotes the complex conjugate, A is the first image, B is the second image, and C is the composite image.

In an alternative example of the disclosure, the wT1 is produced using a Variable Flip Angle (VFA) acquisition. Preferably, the VFA acquisition acquires at least two spoiled multiple gradient echo 3D acquisitions with different excitation flip angles. In this example of the disclosure, the flip angles are between 2^o and 30^o with a repetition time of less than 20ms.

Preferably, in this example of the disclosure the determined wT1 image is calculated from the at least two spoiled multiple gradient echo 3D acquisitions.

In an example of the disclosure the first and second images are obtained after a single inversion pulse. Preferably, the single inversion pulse is an adiabatic pulse.

Preferably, the method of the disclosure also comprises the steps of acquiring further medical images immediately before or after the acquisition of the first and second images. Preferably, the further medical images are multi-echo spoiled gradient echo acquisition images.

In an example of the disclosure, the original first and second MRI images are acquired at 0.3-3.0T.

Brief description of the drawings

Further details, aspects and embodiments of the invention will be described, by way of example only, with reference to the drawings. In the drawings, like reference numbers are used to identify like or functionally similar elements. Elements in the figures are illustrated for simplicity and clarity and have not necessarily been drawn to scale.

Figure 1 shows a cT1 map derived using the 1.5T MOLLI method.