

Hot Topics in Body MRI

Mitsue Miyazaki, PhD (mmiyazaki@tmriusa.com)

Highlights:

- Various non-contrast MRA techniques using spin labeling with half-Fourier FSE and bSSFP are discussed for abdominal vessels, such as renal artery and portal vein.
- In order to differentiate between blood signal and background signals, spin labeling methods are applied depending on the abdominal vessels.

Non-Contrast MR Angiography of Abdomen

Target audience: who wants to study how to apply various non-contrast techniques for target abdominal vessel of interest.

Outcome: researchers are able to apply different techniques for target vessel.

PURPOSE: In this presentation, the latest techniques in abdomen non-contrast (NC)-MRA are introduced. The focus is on the basics of angiography sequences, various spin-labeling techniques, clinical applications in specific arteries and veins, new developments as well as the update of clinical relevance. In particular, spin labeling applications using flow-in, flow-out, and tag-on and tag-off alternate acquisition and subtraction techniques (1) are introduced with specific target vessel applications. The purpose of this presentation is to provide NC-MRA techniques for imaging particular vessels, such as standardization of renal NC-MRA, to discuss the challenges in imaging the hepatic arteries, to explore functional study of portal veins, and to demonstrate the challenges at 3T.

METHODS: There are three spin labeling methods: flow-in, flow-out, and tag-on and tag-off alternate acquisition. The flow-in technique uses only one selective inversion recovery (IR) pulse to observe the blood flow into the inverted region. The flow-out technique uses both non-selective and selective IR pulses to observe the blood flows out from the region received both IR pulses. The alternate tag-on and tag-off method with subtraction permits depicting only the marked blood signal without any consideration of the background. Depending on the application and specific target vessel, spin labeling can be selectively combined with half-Fourier FSE or balanced steady-state free-precession (bSSFP) readout in 2D and 3D acquisitions.

RESULTS: The flow-in technique works well for observing inflow of blood into the vessels of interest, which is suitable for visualization of their angiographic morphology. The flow-out technique only allows observation of outflow from the tagged vessels. The tag-on/off subtraction technique allows observation of only the marked vessels without background signal, at the cost of doubling the scan time. In order to select the appropriate technique, it is important to understand the vessel system in abdomen.

DISCUSSION: In renal non-contrast MRA, the flow-in technique is applied due to strong flow independency of renal arteries with multiple directions of aorta and renal vessels. In addition, careful setting of the inversion time or blood travel time is required to have good contrast between blood and the background kidney signal.

CONCLUSION: NC-MRA techniques are ready to apply. In order to select the appropriate technique, it is important to understand the vessel system in abdomen.

REFERENCE: (1) Miyazaki M and Isoda H. European Journal of Radiology 80:9-23, 2011.