Simultaneous MR and Ultrasound Imaging
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Magnetic Resonance Imaging (MRI) has excellent soft-tissue contrast, multi-planar imaging capability, and sensitivity to subtle changes in tissue morphology and function. Ultrasound imaging, on the other hand, has high temporal resolution volumetric imaging capabilities, the ability to quantify of blood flow, and detect boundaries with small acoustic impedance differences. In addition ultrasound devices have low cost, and portability.

Traditionally MR and ultrasound imaging have been performed in different clinical sessions and the information has been compared by the reader. In more advanced cases co-registration of the two image sets have been performed. Although both of the imaging sets can be performed in the same patient position with a short time interval there are advantages in performing the imaging thoroughly simultaneously. The integration of ultrasound (US) imaging and Magnetic Resonance Imaging (MRI) into a single imaging system has not yet been implemented clinically. Some work has been reported concerning the integration of US and MR imaging systems. A synchronization procedure between MRI and US was proposed [1] in order to perform Doppler measurements in between MR pulses. However, no imaging was performed and no MRI compatible system was developed. The use of a commercial US device electrically shielded while used in a 1.5T MR imager has also been proposed [2-4]. In these studies the shielding reduced interference in MRI but was not completely successful and no MRI compatible transducer was used. As well, the US acquisition was not synchronized with the MR imaging. The basic technical issues related to simultaneous ultrasound and MR imaging were recently investigated and it was found that simultaneous imaging is possible without decreasing the image quality of either method [5]. This was achieved by selecting the ultrasound transducer materials such that they are MRI compatible and by synchronizing the ultrasound data collection during the time between the frequency encoding gradient and the subsequent RF pulse and filtering the RF signal of the ultrasound system.

As a conclusion simultaneous ultrasound and MR imaging may have several advantages to improve diagnosis. Although the technical feasibility has been demonstrated, it has not yet been explored in clinical practice.

References