

Rapid Fetal MRI Using SSFSE, FIESTA and FSPGR Techniques

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Abstract : Fetal Magnetic Resonance Imaging (MRI) is a challenge task because the fetal movements could cause motion artifact in MR images. The remedy to overcome this problem is to use fast scanning pulse sequences. The Single-Shot Fast Spin-Echo (SSFSE) T2-weighted imaging technique is routinely performed and often used as a gold standard in clinical examinations. Fast spoiled gradient-echo (FSPGR) T1-Weighted Imaging (T1WI) is often used to identify fat, calcification and hemorrhage. Fast Imaging Employing Steady-State Acquisition (FIESTA) is commonly used to identify fetal structures as well as the heart and vessels. The contrast of FIESTA image is related to T1/T2 and is different from that of SSFSE. The advantages and disadvantages of these two scanning sequences for fetal imaging have not been clearly demonstrated yet. This study aimed to compare these three rapid MRI techniques (SSFSE, FIESTA, and FSPGR) for fetal MRI examinations. The image qualities and influencing factors among these three techniques were explored. A 1.5T GE Discovery 450 clinical MR scanner with an eight-channel high-resolution abdominal coil was used in this study. Twenty-five pregnant women were recruited to enroll fetal MRI examination with SSFSE, FIESTA and FSPGR scanning. Multi-oriented and multi-slice images were acquired. Afterwards, MR images were interpreted and scored by two senior radiologists. The results showed that both SSFSE and T2W-FIESTA can provide good image quality among these three rapid imaging techniques. Vessel signals on FIESTA images are higher than those on SSFSE images. The Specific Absorption Rate (SAR) of FIESTA is lower than that of the others two techniques, but it is prone to cause banding artifacts. FSPGR-T1WI renders lower Signal-to-Noise Ratio (SNR) because it severely suffers from the impact of maternal and fetal movements. The scan times for these three scanning sequences were 25 sec (T2W-SSFSE), 20 sec (FIESTA) and 18 sec (FSPGR). In conclusion, all these three rapid MR scanning sequences can produce high contrast and high spatial resolution images. The scan time can be shortened by incorporating parallel imaging techniques so that the motion artifacts caused by fetal movements can be reduced. Having good understanding of the characteristics of these three rapid MRI techniques is helpful for technologists to obtain reproducible fetal anatomy images with high quality for prenatal diagnosis.

Keywords : fetal MRI, FIESTA, FSPGR, motion artifact, SSFSE

Conference Title : ICBE 2015 : International Conference on Biomedical Engineering

Conference Location : Kyoto, Japan

Conference Dates : November 12-13, 2015