

Whole body fetal MRI at 3D-true-FISP imaging

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Introduction

Fetal magnetic resonance imaging (MRI) has been conventionally performed using single shot sequences such as HASTE and/or 2D-true-FISP imaging under the maternal breath holding¹. Fetal imaging is often needed for the evaluation of the multiple anomalies such as the combination of the brain and the spine, the chest and the abdomen. Furthermore, 2D imaging has been difficult for the assessment of the continuity of the fetal organs in some cases. Although 3D-true-FISP has been introduced², its utility for the fetus has not been well investigated. The purpose of this study was, therefore, to assess the imaging quality of the whole body fetal imaging using 3D-true-FISP with multi-planar reformation (MPR).

Subjects and Methods

Consecutive twenty fetal imaging with 3D-true-FISP were prospectively performed. MRI scanning was done with a 1.5T unit. The sequence parameters for a 3D-true-FISP imaging were as follows: TR/TE, 3.53/1.56 msec; flip angle, 45-50 degree; matrix, 256×256, slice thickness, 3 mm; field of view, 380 mm. The scanning area was divided to three slabs, and each slab was scanned under breath-holding with the acquisition time of 13 seconds. Subsequently, MPR images were created in the transverse, coronal and sagittal planes to the fetal brain and the trunk respectively. All the images were rated with four point-scales (i.e., 0:poor, 1:fair, 2:good, 3:excellent) by two pediatric radiologists regarding the visualization of each fetal organ contour (i.e., the brain, lung, liver, spleen, gallbladder, stomach, kidney, and bladder) and the imaging artifacts (i.e., the motion artifacts and the artifact between the imaging slabs). The readers were focused to assess the normal fetal organs, and the apparent abnormal regions in the fetus were excluded for the analysis. The differences in the scores in the contour of each organ were compared by using Friedmans test followed by pairwise comparison. Interobserver agreement was assessed by using intraclass correlation coefficients (ICC).

Results

The gestational age of the fetus ranged from 26 to 37 weeks (mean, 32 weeks). The median score of the visualization of the fetal organ contour was 3 in the brain, lung, gallbladder, stomach, and bladder, and 2 in the lung, liver in both readers (Figure 1). The score in the visualization of the organ contour is significantly higher in the brain, lung, liver, gallbladder, stomach, and bladder, compared to the spleen, kidney, and intestine ($p<0.05$). The median score in the motion artifact was 2 (range, 1-3), that of artifacts between the slabs was 2 (range, 1-3) in both readers. ICC was excellent (0.78-0.85) at the brain, liver, gallbladder, stomach, intestine, and bladder, fair to good (0.47-0.68) at the lung, spleen, and kidney. The median score in the motion artifact was 2 (range, 1-3), and artifact between the slabs, 2 (range, 1-3) in both readers.

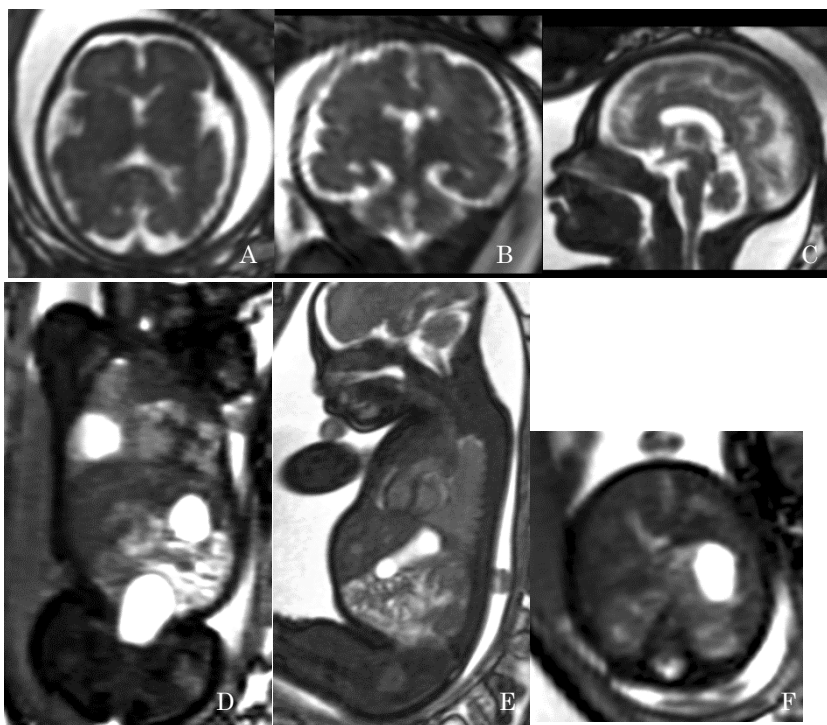


Figure 1.
Multiplanar reformation images of the whole body MRI of a 32-week-fetus using 3D-true-FISP.
A-C: Transverse, coronal, and sagittal images of the fetal brain.
D-F: Coronal, sagittal, and transverse images of the fetal trunk.

Overall demonstration of the fetal organs is good in this case. The brain, liver gallbladder, stomach and bladder are well demonstrated. The lung, kidneys and intestine are slightly less clearly demonstrated. Note that cystic lesion is revealed in the fetal right lung.

Discussion and Conclusions

We found overall relatively good imaging quality of the whole body fetus using 3D-true-FISP. In the assessment of the fetal imaging, it is not a rare occasion that multiple anomalies should be assessed simultaneously. Therefore, this technique can be useful to be an additional sequence to the 2D-sequence. Furthermore, the continuity of the organs and the extent of the lesions can be easier to be grasped using MPR. On the other hand, scanning time is still long for the moving fetus. The severe fetal motion caused artifact in some cases.

In conclusion, 3D-true-FISP imaging with multi-planar reformation may be a useful technique for a whole body fetal imaging.

References

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