Ultrafast, Intrauterine MR Imaging of Fetal Malformation

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Introduction

Until recently, in utero fetal magnetic resonance imaging (MRI) had minimal clinical utility due to marked interference from motion artifacts. Technical advances in the MR soft (ultrafast sequences) and hard ware (fast gradients, surface coils) now allow to apply MRI for prenatal diagnosis.

The aim of this study was to evaluate the ultrafast, T2-weighted single shot fast spin-echo (ssfse) sequence in prenatal diagnosis of fetal malformation.

Methods: Fetuses of 19 pregnant women, in whom a fetal malformation or pathology had been diagnosed by ultrasound, were examined by intrauterine MRI using the ssfse sequence (TE 90 ms, bandwidth 32 kHz, FOV 16–28 cm, matrix 256 x 192, slice thickness 3–5 mm, gap 1.5 mm, NEX 0.5) on a 1.5 Tesla MR system (Signa Horizon LX). Next to the fetal structure, maternal structures (uterus, placenta, pelvimetry of pelvic bones) were assessed. MR findings were correlated with prenatal ultrasound and clinical findings.

Findings: All examinations were diagnostic and of good, motion-artifact-free image quality. Except for the cardiac structures, adequate assessment of all organs, including the central nervous system, was possible by MRI. In 14 patients a sonographically diagnosed CNS-pathology was confirmed (2x ventriculomegalia, 2x aqueductus stenosis, 1x arachnoid cyst, 1x holoprosencephaly, 3x MMC, 1x anencephaly, 1x immature teratoma, 1x complex cerebral malformation, 1x occipital encephalocele, 1x intraventricular hemorrhage). In one fetus, a previously unknown watershed-infarction was detected. A megavesica was indicative of trisomy 13 in one infant. A cervical teratoma was found in one case. One infant presented with a large tumor or the right thigh, a Ewing sarcoma was diagnosed. In one fetus with sonographically suspected tubal pregnancy, MRI diagnosed ectopic, but intrauterine pregnancy and thus supported conservative management. A septate uterus was diagnosed in one, a myomatous uterus in another case.

Interpretation: The present study confirms the results of the group of Edelman that fetal fast MR imaging provides a detailed and reproducible evaluation of normal fetal anatomy and furthermore shows the potential of the ultrafast ssfse sequence in prenatal diagnosis of fetal malformation. MRI is thus likely to become an important adjunct where the ultrasound image is ambiguous or impaired, e.g. by maternal obesity or oligohydramnios. A novel advantage is that the investigation is not absolutely dependent on the prenatal diagnostician’s presence and skills. The images can be stored for subsequent analysis or transmitted to a specialist for a second opinion. This could be valuable in problem cases and for isolated or small institutions.

We predict from this preliminary experience the advent of ultrafast MR sequences will increase the clinical indications for in vivo fetal imaging using MRI.

References