Fetal Cardiographic Monitoring (CTG) during 1.5 Tesla Magnetic Resonance Imaging

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Abstract: To determine the feasibility of fetal CTG during MRI and the safety of 1.5T MRI, 8 pregnant women underwent MR-pelvimetry and fetal MRI (SSFSE) combined with fetal CTG. System modifications included double-shielded cabling and titanium plating over the transducer head electronics. Fetal heart rate, movements and maternal heart rate were recorded before, during, and after MRI. The modified system yielded examinations of diagnostic quality. No significant effect on any test parameter was seen. Fetal CTG is thus feasible during MRI using modified equipment. MRI is safe in that it had no negative short-term effects for the fetus.

Introduction: In principle, the health risks of fetal MRI might derive from the static magnetic field, the voltages induced by sudden changes in the magnetic fields, and radiofrequency-generated heating effects¹⁻³. To date, however, there is no clinical or experimental evidence that MRI has short- or long-term adverse effects on the human fetus. The acoustic noise associated with MRI could also stress the fetal sympathetic nervous system.

Purpose: Our aim was to determine both the feasibility of CTG during MRI and the safety of 1.5 T MRI in terms of its impact on standard prenatal fetal monitoring parameters, namely fetal heart activity and fetal movement.

Materials and Methods: Eight normal pregnant women (33³/7⁻³⁹³/7 weeks, median 36 ± 0 weeks) underwent clinically indicated T1-weighted (fast spoiled gradient-recalled echo sequences) maternal MR pelvimetry and T2-weighted (single-shot fast spin-echo sequences) fetal MRI on a 1.5 T system combined with fetal CTG and maternal electrocardiography. System modifications included double-shielded cabling and titanium plating over the transducer head electronics. Fetal heart rate FHR, including International Federation of Gynaecology and Obstetrics monitoring (FIGO) scores, fetal movements and maternal heart rate were recorded for 30 min before, 10–15 min during, and 30 min after MRI.

Results: The modified system yielded examinations of diagnostic quality (Fig. 1) in all cases. Comparison of pre-, per- and post-MRI data revealed no significant effect of MRI on any fetal (FIGO Score, fetal movement percent, FHR, short-term variation) or maternal test parameter (heart rate, blood pressure, temperature) (Figs. 2 & 3). No pathologic accelerations occurred at any time during examination.

Conclusion: Fetal CTG is feasible during MRI using modified standard equipment. 1.5 T MRI is safe in that it had no negative short-term effects on the heart rate or movement incidence of healthy third-trimester fetuses under our experimental conditions. The ability to monitor fetal well-being during scanning is a valuable safety feature.

References: