Diffusion-weighted MR imaging of the placenta in pregnancies with and without intrauterine growth restriction

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Objective:
To evaluate diffusion weighed MR imaging of the placenta in pregnancies complicated by intrauterine growth restriction (IUGR) compared to normal controls.

Materials and Methods:
Local ethics committee approved the study. In a prospective, observational way, we analysed a continuous series of forty-eight human placentas using 1.5 T MR imaging who requested further fetal investigation for the following reasons: suspected neural or urinary-tract malformation, CMV seroconversion, abnormally invasive placenta (AIP) and IUGR. The apparent diffusion coefficient (ADC) of the whole placenta was calculated upon the diffusion-weighed MR images. IUGR was estimated by ultrasound and correlated to biometrical findings below the 10th percentile. AIP and other pathologic findings were also primarily diagnosed during ultrasonography. Our results were correlated to pathological findings and post-natal outcomes.

Results:
Mean gestational age of pregnant patients was 30 weeks of amenorrhea (range 18-36) and mean ADC for the whole group was $1.9 \times 10^{-3}\text{mm}^2/\text{sec}$ (range 1.0-2.9). The mean ADC of controls (n=17) and AIP (n=5) were with 2.1 and $2.0 \times 10^{-3}\text{mm}^2/\text{sec}$ in the same range. The IUGR group (n=26) could be divided in two subgroups (13 with and 13 without placental insufficiency, based on ultrasound, neonatal and pathological information). The mean ADC was significantly different in these two groups (2.1 versus $1.5 \times 10^{-3}\text{mm}^2/\text{sec}$, $p<0.0001$).

Conclusions:
IUGR related to placental dysfunction is associated in MRI with restricted diffusion and reduced ADC compared to control or AIP placentas. Decreased placental ADC might be a sign of altered function in cases of intrauterine growth restriction (IUGR) caused by placental insufficiency.