SAR Calculation in Human Fetuses in the Second and Third Trimester of Pregnancy during MRI

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For magnetic resonance imaging (MRI) one generation ago, the imaging time was long and the acquired image was not necessarily high-quality. However, in resent year, MRI has enabled high-speed imaging and high-resolution imaging. The utility of the MRI for fetal diagnosis such as fetal abnormality during pregnancy is getting highly appreciated because it enables to obtain very clear morphological images of the human tissues in short time. In MR imaging, the radio-frequency (RF) coil radiates pulsing electromagnetic (EM) waves to the human body. Therefore, it is necessary to estimate the specific absorption rate (SAR) in the human body due to the radiated EM energy from the RF coil in MRI scanner [1, 2, 3].

Fetal size and the anatomical structures of gestational tissues including fetal tissues vary with fetal growth of pregnancy. Abdominal body-types of pregnant female vary also with fetal growth. In order to evaluate the SAR for fetuses of pregnancy due to the radiated EM energy from the RF coil, we used the pregnant female models with anatomically correct fetal and gestational tissues in the second and third trimesters of pregnancy by combining a Japanese female model with the fetal models constructed on the basis of the fetal MRI data from a healthy normal pregnant volunteer [4]. The models are those at 20, 26 and 29 weeks of pregnancy. The models are also composed of voxels 2 mm × 2 mm × 2 mm, and consist of over 70 different tissues types.

In this presentation, we discuss the SAR in fetuses during pregnancy exposed to MRI EM radiation generated by the commonly used birdcage coils at 64 and 128 MHz by the pregnant female models using the finite-difference time-domain (FDTD) method.

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