

Abstract 45526

RF heating reduction associated to an MR endoluminal coil at 3T

Category: Scientific Session Communications

Topic: Preclinical Studies and Basic Science / Interventional, safety, bioeffects

Authors: J.-M. Verret¹, F. Pilleul¹, C. Rabrait², O. Beuf¹; ¹Villeurbanne/FR, ²Buc/FR**Purpose / Introduction**

MR endoluminal coils increase the Signal-to-Noise Ratio (SNR), allowing better distinction of the layers of the bowel: a crucial criterion for diagnosis of bowel diseases [1]. But they present a risk of burn for the patient. Radio Frequency (RF) electric field may cause important heating due to local concentrations of the E-field along the conductive cable and coil [2]. In this paper, the efficiency of RF traps toward heating suppression was assessed. The particular case of a 225 cm long receiver cable was with a cable path configuration tested to be in the worst case scenario.

Subjects and Methods

Experiments were performed on a GE DVMR750 3T system (General Electric Medical Systems). Endoluminal coil is a double loop coil prototype (60 mm length, 6 mm width) developed at CREATIS and was placed in 1.5 % agar gel phantom, an adequate medium for heat propagation. Four optic fiber probes were taped on the endoluminal coil: 3 at the distal extremity and 1 at the proximal base and connected to a temperature measurement device (Opsens Tempsens: 0.1 °C resolution, 0.357 Hz sampling rate). A FIESTA was performed with Acquisition Time: 1min36, 35° flip angle ; FOV :48*48 cm², matrix 128*128, 250 KHz Bandwidth, TE/TR : 0.988/2.7ms. The receiver cable was an RG 58 coaxial cable 225cm long incorporating between 0 and 5 RF traps. Inside the MRI bore, the receiver cable path passed through the maxima of the electric field, located with an electric dipole associated to a LED (Agilent HLMP 4015)

Results

Maximum temperature elevations measured at different locations in function of the number of traps are summarized in Table1.

Table 1: Maximum temperature rise in °C (5 measurements)

| # RF traps | Distal 1 (mean, std) | Distal 2 (mean, std) | Distal 3 (mean, std) | Proximal 1 (mean, std) |
|------------|----------------------|----------------------|----------------------|------------------------|
| 0 | 14.66 , 1 | 8.13 , 0.48 | 7.57, 0.83 | 1.55, 0.17 |
| 1 | 8.5,0.25 | 6.35, 0.18 | 5.02, 0.2 | 0.92, 0.2 |
| 2 | 1.56, 0.45 | 0.89, 0.2 | 0.96, 0.25 | ~0 |
| 3 | 0.94, 0.09 | 0.55, 0.08 | 0.59, 0.07 | |
| 4 | 0.52, 0.03 | 0.38, 0.7 | 0.42, 0.08 | |
| 5 | 0.30, 0.03 | ~0 | | |

Discussion/Conclusion

RF heating is a local phenomenon which occurs mostly at distal extremity. Without RF traps, observed maximum temperature increase was $14.66 \pm 1^\circ\text{C}$ which would cause necrosis. In the worst case scenario, 5 RF traps efficiently suppressed heating for a cable length of 225 cm

References

- [1] Pilleul, F, 2005, Lyon 1 Thesis
 [2] C. Armenean et al., 2004, *Magn Reson Med* 1200-1206

