ELECTRICAL CONDUCTIVITY IMAGING WITH 7T PRECLINICAL MRI USING MR ELECTRICAL PROPERTIES TOMOGRAPHY

Prakash Parappurath Vasudevan*[1], Reza Aminzadeh[2], Nele De Geeter[3], Benedicte Descamps[1], Luc Dupré[3], Wout Joseph[2], Roel Van Holen[1]

[1]Dept. of Electronics and Information Systems (ELIS), Ghent University, Ghent, Belgium

[2]Dept. of Information Technology (INTEC), Ghent University, Ghent, Belgium

[3]Dept. of Electrical Energy, Metals, Mechanical Constructions and Systems (EEMMeCS), Ghent University, Ghent, Belgium

Keywords: Electrical properties tomography; EPT; MRI; conductivity; tumor imaging

1. INTRODUCTION

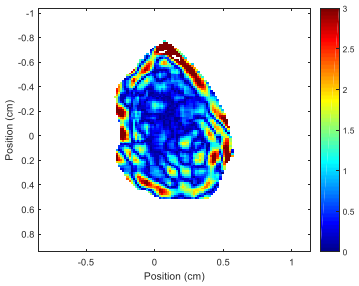
The accurate assessment of dielectric properties of human tissue is important for radio-frequency (RF) absorption measurements and has significant impact on medical applications and diagnosis. Magnetic Resonance Electrical Properties Tomography (MREPT) is a method to assess the Electrical Properties of tissues *in vivo* from the RF magnetic field (B1+) at Larmor frequency. This method uses standard magnetic resonance imaging (MRI) equipment without the need of any additional hardware. Studies have shown the feasibility of phase-based conductivity reconstruction, which uses only B1+ phase for the conductivity mapping [1,2]. This study evaluates the phase only conductivity imaging at 7T using preclinical MRI.

2. MATERIALS AND METHODS

The experimental studies were carried out on phantom and a mouse tumor model. A mouse bearing breast tumor on hindlimb was then used for *in vivo* studies. The mouse was euthanized, and the tumor region was extracted. Measurements were performed on the extracted tumor and electrical conductivity was reconstructed at 300MHz. The experiments were performed on a 7T MR scanner at Ghent University, Belgium with a quadrature birdcage RF coil with 40 mm diameter.

Two 2D spin echo (SE) images with Repetition Time (TR) of 1600ms, Echo Time (TE) of 12ms, resolution of 0.3x0.3x0.9 mm^3 and four averages on five axial slices were used to obtain eddy current corrected B1+ phase images. The conductivity was calculated from the transmit phase φ_+ using [2]:

$$\sigma(r) = \frac{\nabla^2 \varphi_+(r)}{\omega \mu} \qquad (2)$$



Reconstructed Conductivity (S/m)

3. RESULTS AND DISCUSSION

Average conductivities determined for the breast tumor is 0.53 ± 0.41 S/m. The results are in good agreement with the expected values. The standard deviation represents the spatial variation of conductivity in ROI.

The results show that the conductivity mapping using only the transmit phase is possible in piece-wise constant conductivity regions, which confirms the possibility of conductivity assessment in different pathological conditions.

References

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