UCLA TECHNOLOGY DEVELOPMENT GROUP

Non-Invasive Method For Determination Of Tissue Electrical Conductivity

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SUMMARY

UCLA researchers in the UCLA Semel Institutes of Neuroscience and Behavior have developed a non-invasive method to locate and estimate electrical currents in organs such as the brain and heart.

BACKGROUND

Electrical conductivity of biological tissues, such as the brain and heart, has been implicated in a number of disease processes such as epilepsy and cardiac arrhythmias. Magneto-encephalography (MEG) and Electro-encephalography (EEG) are the commonly used non-invasive techniques to measure and localize intracranial current sources.However, accurate localization of intracranial current sources using these techniques is dependent on a number of parameters that are difficult to estimate, and therefore lead to inaccuracies. Additionally, knowledge of cardiac conductivity is needed in the noninvasive determination of aberrant sources of cardiac arrhythmias for ablation therapy.

Diffusion tensor imaging (DTI) is an increasingly popular MRI technique that can estimate the connectivity patterns of the white matter in the brain, as well as the arrangement of myocardial fibers in the heart. DTI can track highly structured fiber architecture such as those in the brain and heart on the basis of the highly directional diffusion of water along such fibers. Measurements of tissue sodium concentration are also becoming increasingly important in understanding the extent of tumors, areas of epileptogenic activity, and changes of diagnostic value in diseases such as Alzheimer’s and Parkinson’s.

INNOVATION

Researchers at UCLA have developed a methodology that combines DTI-estimated water diffusivity and measurements of tissue sodium concentration to accurately determine tissue conductivity. The proposed method uses MRI to determine the local concentration of tissue ionic carriers such as sodium.

APPLICATIONS

- Accurate localization of intracranial electrical and magnetic sources prior to intracranial surgery for epilepsy or brain tumors
- Accurate differentiation of stable vs. unstable strokes to indentify candidates for early-stage intervention to minimize tissue damage
- Guidance of deep brain stimulator implantation for treating disorders such as Alzheimer’s, Parkinson’s, and depression
- Diagnostic and surrogate endpoint for Alzheimer’s disease, Parkinson’s disease and other degenerative disorders
- Noninvasive localization of cardiac sources of arrhythmia for treatment

ADVANTAGES

- Non-invasive
- Provides information on localization and source of electrical signal
- Provides information on tissue viability in stroke and tumors
- Provides diagnostic and prognostic information upon treatment of brain disorders

RELATED MATERIALS

- Akhtari, M., et al. "Electrical conductivities of the freshly excised cerebral cortex in epilepsy surgery patients; correlation with pathology, seizure duration, and diffusion tensor imaging." Brain Topography 18.4 (2006): 281-290.
- Akhtari, M., et al. "Measuring the local electrical conductivity of human brain tissue." Journal of Applied Physics 119.6 (2016): 064701.

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INVENTORS

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OTHER INFORMATION

KEYWORDS

Brain conductivity, diffusion tensor imaging, water diffusivity, brain, electrical conductivity, Alzheimer’s, Parkinson’s, epilepsy, tumor, non-invasive, MRI, tissue conductivity, intracranial, magnetic, stroke

CATEGORIZED AS

- **Imaging**
  - Medical
- **Medical**
  - Disease: Cardiovascular and Circulatory System
  - Disease: Central Nervous System
  - Imaging
  - Research Tools

RELATED CASES

2015-189-0

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	10,197,657	02/05/2019	2015-189

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