Simultaneous pH- And Oxygen-Weighted MRI Contrast Using Multi-Echo Chemical Exchange Saturation Transfer Imaging (ME-CEST)

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INVENTORS

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OTHER INFORMATION

KEYWORDS

Chemical exchange saturation transfer, CEST, magnetic resonance imaging, MRI, brain tumor imaging, traumatic brain injury, pH-weighted, hypoxia

CATEGORIZED AS

- **Imaging**
- **Medical**
  - Diagnostics
  - Disease: Cancer
  - Imaging
  - Research Tools

RELATED CASES

2017-794-0

SUMMARY

UCLA researchers in the Department of Radiological Sciences have developed a magnetic resonance imaging (MRI) technique that simultaneously acquires acidic and hypoxic information often associated with brain tumors and traumatic brain injury (TBI).

BACKGROUND

Magnetic Resonance Imaging (MRI) is the primary imaging modality in brain tumor and traumatic brain injury patients. However, traditional MRI techniques cannot characterize the local aggressiveness and metabolic dysfunction of heterogeneous brain tumors or the brain after traumatic injury, which could be useful for monitoring patient response to treatment with higher accuracy. More specifically, no MRI techniques simultaneously collect pH-weighted and hypoxia-weighted information to assess the acidic and hypoxic regions associated brain tumors or the brain after injury. Thus, there is a commercial need for quantifying molecular information in brain tumors and the brain after injury beyond that given by traditional anatomic MRI.

INNOVATION

UCLA researchers have developed a chemical exchange saturation transfer (CEST) magnetic resonance imaging (MRI) technique for simultaneous acquisition of pH- and hypoxia-weighted image data. This technique acquires both pH-weighted and hypoxia-weighted information using a single MRI sequence, where no other MRI sequence developed to date can acquire both types of information. This allows for identification of acidic and hypoxic regions associated with abnormal metabolism, proliferative tumors, and excitotoxicity associated with TBI. This technique can monitor treatment response and determine targets for surgery, radiotherapy, and/or other types of interventions. The MRI sequence can be acquired within a clinically feasible scan time of approximately 7.5 minutes. Furthermore, this sequence provides full brain coverage due to the fast readout, unlike previous CEST applications in which only a small number of slices can be acquired due to slow readout methods. Moreover, this sequence can be implemented on any clinical 3T scanner.

APPLICATIONS

- Brain tumor characterization
- Traumatic brain injury characterization
- Acute stroke characterization

ADVANTAGES

- Simultaneous information collected on acidic and hypoxic regions in tumor or injured brain
- Short scan time (7.5 minutes)
- Full brain coverage (large field of view)
- Can be readily implemented into clinical 3T MRI scanners

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,061,094	07/13/2021	2017-794

RELATED MATERIALS

- Harris RJ, Yao J, Chakhoyan A, Raymond C, Leu K, Liau LM, Nghiemphu PL, Lai A, Salamon N, Pope WB, Cloughesy TF, Ellingson BM. Simultaneous pH-sensitive and oxygen-sensitive MRI of human gliomas at 3 T using multi-echo amine proton chemical exchange saturation transfer spin-and-gradient echo echo-planar imaging (CEST-SAGE-EPI). Magn. Reson. Med. 2018.
- Harris RJ, Cloughesy TF, Liau LM, Nghiemphu PL, Lai A, Pope WB, Ellingson BM. Simulation, phantom validation, and clinical evaluation of fast pH-weighted molecular imaging using amine chemical exchange saturation transfer echo planar imaging (CEST-EPI) in glioma at 3?T. NMR Biomed. 2016.
- Harris RJ, Cloughesy TF, Liau LM, Prins RM, Antonios JP, Li D, Yong WH, Pope WB, Lai A, Nghiemphu PL, Ellingson BM. pH-weighted molecular imaging of gliomas using amine chemical exchange saturation transfer MRI. Neuro Oncol. 2015.

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Integrative Leakage Correction For Contrast Agent Extravasation In Dynamic Susceptibility Contrast (DSC) - MRI
- pH-Weighted MRI Using Fast Amine Chemical Exchange Saturation Transfer (CEST) Imaging
- Multi-Echo Spin-, Asymmetric Spin-, And Gradient Echo Echoplanar Imaging (Message-EPI) MRI

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