Efficient Method of Mapping Sources of Abnormal Routes of Vascular Circulation Regardless of Their Location Using MRI

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BACKGROUND

In conventional vessel encoded ASL (VEASL), pseudo-continuous ASL tagging is used with additional gradient pulses applied across the tagging plane to encode the data with information about the location of the feeding arteries. In most implementations, prior information on the locations of feeding arteries in the tagging plane has been used to optimize the encoding process. However, in some cases, the relevant supplying arteries are not known ahead of time, as there may be variant or collateral circulation. In addition, the resonance offset in the tagging plane is known to affect the tagging efficiency.

TECHNOLOGY DESCRIPTION

UC San Diego researchers have developed an efficient method for estimating both the location and resonance offset of all feeding arteries of VEASL from randomly encoded data, allowing for identification of source vessels without prior knowledge of their locations. The method uses unipolar rather than bipolar vessel encoding gradient lobes providing the same encoding functionality, which results in nearly complete insensitivity to resonance offsets at the tagging plane.

ADVANTAGES

The method detects and identifies sources of abnormal (collateral) routes of circulation regardless of their location, providing the clinician with important information for patient management. In clinical applications, the locations of some of the feeding arteries is typically known, but when there is vascular disease, which is the primary application of this class of imaging methods, there are often collateral routes of circulation that develop to perfuse the affected tissues. These collateral sources are often difficult to identify *a priori*.
The use of unipolar rather than bipolar vessel encoding gradient lobes results in nearly complete insensitivity to resonance offsets at the tagging plane, a feature that the original VEASL did not have, and it also provides a means for measuring the frequency offsets themselves.

STATE OF DEVELOPMENT

A working software on a GE MRI scanner has been developed and can be adapted to other MRI scanners. Experimental data collected in human subjects, demonstrating successful identification of feeding arteries without prior knowledge of their locations.

APPLICATIONS

- Diagnostic imaging in stroke
- Image based guidance for intra-arterial treatment of stroke
- Risk assessment for stroke
- Evaluation of blood supply to tumors
- Evaluation of blood supply to organ transplants, such as kidneys
- Evaluation of collateral blood supply in carotid or other cerebrovascular disease

RELATED MATERIALS

- Guo J, Wong EC, Blind Detection of Source Vessel Locations and Resonance Offsets Using Randomly Encoded VEASL, 2011 ISMRM 19th Annual Meeting Abstract#294.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9,192,322	11/24/2015	2011-314
United States Of America	Issued Patent	8,195,274	06/05/2012	2007-238

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OTHER INFORMATION

KEYWORDS

velocity selective arterial (ASL), vessel encoded arterial spin labeling (VEASL), MRI, imaging, stroke, blood supply

CATEGORIZED AS

- **Medical**
  - Diagnostics
  - Disease: Central Nervous System

RELATED CASES

2011-314-0, 2007-238-0

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