Quantitative Imaging Biomarkers Alliance RSNA

Application for QIBA Project Funding

Title of Proposal: DCE-MRI Phantom Fabrication, Data Acquisition and Analysis, and Data Distribution		
QIBA Committee/Subgroup: DCE-MRI Technical Committee / MRI Modality Committee		
NIBIB Task Number(s) which this project addresses: 2 (primary), 1 & 9 (secondary)		
Project Coordinator or Lead Investigator Information:		
Last Name: Jackson	First Name: Edward	Degree(s): PhD
e-mail:	Tel #:	
Institution/Company: The University of Texas M.D. Anderson Cancer Center		
Amount Requested:		

- [x] 1. Identification of Technical Characteristics and Standards
  - [x] a. Creation and refinement of protocols for image acquisition, analysis, quality control, etc., for specific clinical utility
  - [x] b. Phantom development and testing
  - [ ] c. Identification and assessment of intra-reader bias (1) and variance across scanners and centers
  - [ ] d. Identification and assessment of inter-reader bias and variance across scanners and centers
  - [ ] e. Other
- [ ] 2. Clinical Performance Groundwork
  - [ ] a. Assessment of intra-reader sensitivity and specificity
  - [ ] b. Assessment of inter-reader sensitivity and specificity
  - [ ] c. Other
- [ ] 3. Clinical Efficacy Groundwork
  - [ ] a. Assessment of correlation between new biomarker and 'accepted-as-standard' method
  - [ ] b. Characterization of value in clinical trials
  - [ ] c. Characterization of value in clinical practice
  - [ ] d. Development/merger of databases from trials in support of qualification
  - [ ] e. Other
- [x] 4. Resources (money and/or people) committeed from other sources.

Matlab/IDL licenses and computational resources (M.D. Anderson Cancer Center, Dept of Imaging Physics)

Please provide a one-page summary that includes the following information:

Project Description

The DCE-MRI Technical Committee has developed a prototype DCE-MRI phantom that is proposed for use in DCE-MRI clinical trial site qualification as well as ongoing quality control processes. When it was initially formed, the DCE-MRI Technical Committee identified the need for such a robust DCE-MRI contrast response phantom as a top priority. Since that time, the committee developed a "generic" DCE-MRI acquisition protocol, developed a protocol for quality control / initial site qualification, each process a key component of the first DCE-MRI Profile, and has evaluated the use of a modified ADNI MagPhan phantom and, upon initial multicenter testing of two copies of this phantom design, found the phantom to be insufficiently robust to shipping and handling, too limited in its evaluation of R_1 (longitudinal relaxation rate) contrast response assessment, and not time efficient in routine application. A new phantom design was proposed to address each identified weakness of the modified ADNI MagPhan phantom for DCE-MRI contrast response characterization, relaxometry, and quality control.

Primary goals and objectives

This project has four primary goals and objectives:

1) Obtaining four copies of a commercialized version of the current prototype phantom design.
2) Collaboration with VirtualScopics (Ed Ashton, PhD) to develop/validate a freely distributed software package that will take as input: a) multi-flip angle fast gradient echo T1 mapping data, b) multi-TR T1 mapping data, c) multi-TI T1 mapping data, d) source fast gradient echo phased array and body coil images to be used for phased array intensity correction calculations, and e) DCE-MRI fast gradient echo data. The software will automatically determine the appropriate regions of interest for all required calculations and produce as output: a) T1, R1, and M0 measures for each ROI from both the raw and signal intensity corrected data, b) DCE-MRI signal-to-noise ratio (SNR) measures and DCE-MRI signal intensity vs. R1 plots (raw and signal intensity corrected) for all relevant ROIs, and c) summary statistics for all relevant measures.
3) Phantom distribution to and analysis of data from a minimum of four sites with MR systems from three vendors (GE, Philips, Siemens), including at least one site outside of North America, *e.g.*, the University of Freiburg.
4) Preparation and distribution of source and metadata to a publically accessible database, *e.g.*, the NCI caBIG Imaging Workspace National Biomedical Imaging Archive (NBIA).

Deliverables

The deliverables for this project are identified in goals and objectives 2) and 4), above. Specifically, the deliverables are: 1) validated software (in collaboration with the VirtualScopics project, Ed Ashton, PI) for analysis of data obtained from the RSNA QIBA DCE-MRI phantom, 2) four copies of the RSNA QIBA DCE-MRI phantom, 3) data from a minimum of four sites (three MR system vendors), 4) source data and metadata available for distribution to a publically accessible database, e.g., the NCI caBIG Imaging Workspace National Biomedical Imaging Archive (NBIA).

Timeline [must include intermediate measureable milestones.]

The timeline for completion of the proposed goals and objectives is one year from receipt of funds. The phantoms should be obtained in **2** months. The phantoms will be distributed to sites and scanned for **5** months. The data analysis software will be developed at VirtualScopics in parallel to these intermediate steps. The analysis of the data from the multicenter sites and final optimization of software code will require **3** months. Finalization of the source data and associated metadata and uploading of all data to an appropriate publically accessible database, *e.g.*, NBIA, will require the final **2** months.