

QIBA fMRI Subcommittee Breakout Session
QIBA Meeting
Hyatt Regency O'Hare
May 25-26, 2010
Breakout Session Summary

Day 1, May 25, 2010

In Attendance

Jeffrey Petrella, MD (moderator)
Srinivasan Mukundan, Jr, MD, PhD
James L. Reuss, PhD (by telephone)
Daniel C. Sullivan, MD
James T. Voyvodic, PhD

RSNA Staff
Madeleine McCoy

Topics for discussion:

- Discuss QIBA Profile and define claims
- Decide the intended use of the fMRI group as it relates to QIBA
- Devise a model of fMRI clinical workflow; sample workflow received from Dr Petrella (Duke)

QIBA

- Quantitative biomarker is missing in fMRI and the decision of what level the biomarker needs to be at should be discussed
- QIBA fMRI group to be modeled after other QIBA quantitative committees
- Quantitative processing of data more objective than a qualitative judgment by a radiologist
- DCE-MRI representative to discuss process and phantom design at 5/26/10 breakout

Clinical Decisions

- Quantifying Risk Predictions
 - Need readout data showing outcomes in objective terms
- Laterality index of language needed based upon signal magnitude change
- Determine how data is analyzed for...
 - The physical basis of the fMRI signal
 - Outcome of the patient
 - Biomarker is a BOLD signal; the magnitude of the signal is important
- Lesion location
- Map shows the language and motor areas of the brain
- Volume of lesion is recorded
- Distance is defined

Drug Trials:

- Use receiver operator curves to decide threshold

- Schizophrenia, epileptics, smokers and other groups can be studied
- Establish whether reproducibility can be quantified

Communication between radiologists and surgeons

- Measure of confidence of surgeons using fMRI

Reproducibility

- BOLD Signal
 - The reaction of the patient's brain while performing or not performing a task
 - Differentiation percent signal change from noise
 - Relationship between signals and reproducibility; how a signal can be detected
 - Spatial distribution more reproducible than strength of signal

Workshop Proposal (summer 2010):

- Discussion of hosting a neurosurgical planning focus session to discuss methods for fMRI clinical planning; potential for RSNA/QIBA support
- One day-30 people to be invited; neurosurgeons, radiologists, physicists-include those who are not closely involved with fMRI
- Possibility of collaborating with a professional organization AANS or CNS
- Educational component
- Reproducibility of test-retest data
- Include epilepsy which is 1/3 of the cases studied
- Better define Claim based on reproducibility of test-retest data
 - Include motor, language and audio as three separate categories

QIBA fMRI Profile on Wiki (http://qibawiki.rsna.org/index.php?title=FMRI_subctte):

- Based on pre-surgical planning
- Claims need to be established for each task; a guide of where to go
 - Claim #1
 - In normal subjects, on a test-retest basis, fMRI can be performed reproducibly to a level such that the center of mass of activation of a focus of interest is within 5mm of itself, and with at least 90% overlap of the activation clusters.

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Day 2, May 26, 2010

In Attendance

Jeffrey Petrella, MD (moderator)

Jeffrey Evelhoch, PhD

Srinivasan Mukundan, Jr, MD, PhD

Daniel C. Sullivan, MD

James T. Voyvodic, PhD

RSNA Staff

Madeleine McCoy

Discussion of phantom design:

- Dr Evelhoch joined the group to discuss his experiences with the DCE-MRI group
- Flow phantom versus non-flow phantom discussed
- Change in the phantom modeling needed; smaller tubes to be used in fMRI phantom
- Phantom to determine accuracy of BOLD response measurements

Goal:

- To have an accurate means of mapping brain function with respect to lesions
- The functional BIRN (Biomedical Informatics Research Network) study was referenced in discussing variability between people.
 - <http://www.birncommunity.org/current-users/function-birn>
- Profile for fMRI Brain Mapping continues to be discussed while revising Claims
- Clinical trials for tumors and epilepsy -- is this is the most quantitative use spatially
- Drug evaluations
- Keep within the QIBA spirit-involve manufacturers
- Possibility of having two profiles which both include reproducibility focusing on:
 - Surgical Planning
 - Parametric Response
 - Each having separate claims for motor skills and language skills is in question
- The measure criteria should include:
 - Test-retest
 - Consistency
 - Reproducibility
 - Stability versus change

New Claims:

- On a test-retest basis, fMRI can be performed reproducibly to a level such that the center of mass of activation of a focus of interest is within 5mm of itself, with at least 90% overlap of the activation clusters.
- On a test-retest basis, fMRI can be performed reproducibly to a level such that the relative magnitude of activation in homologous regions across hemispheres should be within 10%.
- Quantitative measures of "risk" to eloquent brain structures... distance metrics... etc.

Next Steps:

- Create a roadmap to refine Claims
- Assess test-retest multisite reproducibility by using ASFNR to develop a harmonized approach across institutions
- Collaborate with FBIRN, ADNI, QIBA FDG-PET; invite to conf calls
- Develop phantom to calibrate T2* and fSNR.
- Assess geometric spatial accuracy with B Field mapping to correct geometric distortion
- Enroll our “customers” in conf calls or stand alone meeting