QIBA fMRI Biomarker Committee (BC) Call
Wednesday, April 15, 2020 at 11 a.m. CT
Call Summary

In attendance   **RSNA staff**

Feroze Mohamed, PhD (Co-chair)   Ichiro Ikuta, MD, MMSc   Nicolás Sánchez Domínguez, MD   Joe Koudelik

David Soltysik, PhD (Co-chair)   Andrew Kalnin, MD   Kiran Talekar, MD   Susan Stanfa

Jay J. Pillai, MD (Co-chair)   Ho-Ling (Anthony) Liu, PhD   James Voyvodic, PhD

Cathy Elsinger, PhD   Nancy Obuchowski, PhD   Yuxiang Zhou, PhD, DABR

Ping Hou, PhD

Review of Previous Call Summary

- The 04.01.2020 call summary was approved as presented

Discussion re: new language lateralization paper distributed prior to call

Brumer I, et al. **Implementation of clinically relevant and robust fMRI-based language lateralization: Choosing the laterality index calculation method**. *PLoS ONE*. 2020; 15(3): e0230129.

- Dr. Elsinger and pediatric neuropsychologist colleagues had discussed how to calculate laterality
- The goal of the paper was to devise a threshold-independent method of defining ROIs that could be used in clinical practice
- The assessment of language lateralization has become widely used when planning neurosurgery close to language areas, due to individual specificities and potential influence of brain pathology
- fMRI allows for a non-invasive, quantitative assessment of language lateralization for presurgical planning using a laterality index (LI); however, the conventional method is limited by the dependence of the LI on the chosen activation threshold
  - The purpose of this study was to propose a simplified approach to threshold-independent LI calculation and compare it with three previously reported methods on the same cohort of subjects
  - To overcome this limitation, different threshold-independent LI calculations have been reported
  - Various LI approaches were compared, and multiple methods were shown to work
    - Which LI approach to recommend for the Profile may not prove critical since the results were mostly comparable across the different methods
- Dr. Voyvodic summarized the paper's methodology; from the abstract:
  - Fifteen healthy subjects, who performed picture naming, verb generation, and word fluency tasks, were scanned
  - LI values were calculated for all subjects using four methods, and considering either the whole hemisphere or an atlas-defined language area
  - For each method, the subjects were ranked according to the calculated LI values, and the obtained rankings were compared
  - All LI calculation methods agreed in differentiating strong from weak lateralization on both hemispheric and regional scales (Spearman's correlation coefficients 0.59–1.00)
  - Regions of Interest
    - LI was calculated using both hemispheric and regional ROIs; for the definition of the ROIs, different brain atlases available in FMRIB Software Library (FSL) were employed
    - The language ROIs encompassed Broca's area (BA) and Wernicke's area (WA) (posterior division of the superior temporal gyrus)

- - - Threshold-independent LI calculation methods:
    - Fixed total number of activated voxels (curveLI) (Abbott et al, 2010)
    - Average (AveLI) (Matsup et al., 2012)
    - Weighted histogram (histoLI) (Branco et al., 2006, Suarez et al., 2008)
    - Area under the curve (AUCLI)
  - The paper claims that all methods and ROIs provided similar results

- Results
  - As the threshold is raised, laterality will tend to move one way or another
  - There is a greater spread (95% confidence interval of the mean LI is larger) in the picture naming task, indicating that the intersubject variability in LI is greater with this task, compared to other tasks; this finding is similar to previously reported results (e.g., Pillai et al., Neuroimage 2011)
  - As both task and ROI have an impact on the LI distribution, the same subject can have different degrees of lateralization in different tasks or ROIs
  - Fig. 5 shows that higher LI values were seen for:
    - Language regional ROIs compared to hemisphere ROIs
    - Verb generation, word fluency tasks
    - histoLI index (though this involves a weighting function with squared t-values)

- It was concluded that the whole hemisphere approach will not be used in the fMRI Language-Mapping Profile
  - Using ROIs that are too large can dilute the LI by including bilateral activation as well as activation in non-language-specific regions
  - ROIs suggested by literature to be the most closely associated with functional laterality of language, e.g., BA and WA to be chosen
  - No additional discussion needed re: ROIs to be included

- In choosing methods for calculating LI, the focus will be on the reproducibility of these measures
- LI deemed meaningless if there is not good activation
  - Methodology to be developed for deciding which scans could meet the qualifications for the Claim
  - Clear quality control criteria for defining a "good" scan still need to be determined, i.e., how do we determine if scan performance meets Profile requirements?

- Introduction of new fMRI BC member, Nicolás Sánchez Domínguez, MD
  - From Neuroradiology section, Department of Radiology, Facultad de Medicina Clínica Alemana - Universidad del Desarrollo, Santiago, Chile
  - Currently serving for one year as a Visiting Research Scholar in the Department of Radiology at Duke University, specializing in language fMRI

Next call: Wednesday, May 6, 2020 at 11 a.m. CT (1st & 3rd weeks of each month)