TOP-NT NEUROIMAGING WORKGROUP

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PRECLINICAL NEUROIMAGING HARMONIZATION SUBGROUP

• Highly collaborative, multi-site team-based effort to harmonize acquisition protocols at different field strengths (7 and 11.7 Tesla), image processing, and assemble common data elements (CDE) to facilitate the reporting of imaging data:
  • The Neuroimaging team: Neil G. Harris (UCLA), Jinyuan Zhou (JHU), Alexandru Korotcov (USUHS), Christopher Albanese, Mark Burns and Xiong Jiang (Georgetown), Marcelo Febo (UF)

• Guided (and mandated) by NIH/NINDS at every step of the way

• Standardizing protocols for image acquisition

• Standardizing image post-processing, data extraction from images, and statistical analyses
  • Statistical parametric mapping – TBI scans thresholded by z normalized sham group

• Reporting with CDEs – working with odc-tbi.org team (Adam Ferguson et al. UCSF)
MR IMAGING DATA HARMONIZATION: EASIER SAID THAN DONE

**Image acquisition**
- MR Hardware (e.g., RF coils, field strength, gradients, setup, engineering support, etc.)
- MR acquisition software and available pulse sequence packages (3D DTI-EPI, GEEPI, APTw)

**Image Processing**
- Image processing pipelines (In-house, AFNI, FSL, ANTs, etc)
- Availability of high-performance computer facilities or high-end computational resources
- Staff with programming skills
- Availability of brain atlases/parcellations and
- Decisions regarding statistics (e.g., whole brain vs. ROI analyses for DWI, ICA, Seed, vs Hcorr for fMRI)

**CDE Reporting/Data Sharing**
- Statistical Map
  - Number of voxels with $Z > 3.1, p < 0.001$
- DWI/DTI
- fMRI
- APTw
COMMON DATA ELEMENTS FOR PRECLINICAL IMAGING MARKERS

• Differences odc-tbi tabulation vs Bruker parameter file information (will also vary from any sites using other MRI vendor platforms like MR solutions or Varian)
  • $\text{ImgDiffusionFirstBVal} = \#\#PVM\_DwBvalEach=\( 1 \)
  • $\text{ImgDiffusionGrdtDur} = \#\#PVM\_DwGradDur=\( 1 \)

• MRI CDEs from human TBI neuroimaging vs preclinical TOP-NT CDE may in some cases be similar but in others not available from MRI parameter files (will need manual entry)
  • $\text{ImgFMRITaskTyp} = \text{Tasks performed during a functional magnetic resonance imaging (fMRI) scan}
  • $\text{ImgFatSignalSuppressedInd} = \#\#PVM\_FatSupOnOff=\text{On}

• Translation of MRI software parameter files to data entry sheets will be key (can be automated via programming)
## Magnetic Resonance Imaging 175: 151+24 on data

<table>
<thead>
<tr>
<th>FITBIR MRI organization</th>
<th>CDEs</th>
<th>New TOP-NT CDEs</th>
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<tr>
<td>119+7 TOP-NT CDEs placed into Form structures</td>
<td>56: 49 adopted, 7 modified</td>
<td>94+24=119</td>
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<tr>
<td>Subject 46</td>
<td>4+7</td>
<td>35 Monitoring vitals</td>
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<td>22 subject +24 on data = 46</td>
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<td>Phase and reverse ph. direction and number</td>
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<td>←</td>
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<td>7 Method, measure, unit, blinding</td>
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<td>←</td>
<td>←</td>
<td>7 Method, correction method, saturation pulse spec’s</td>
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Wanner IB et al., in preparation
GENERAL POINTS ON A PERSONAL VIEWPOINT OF TOP-NT EXPERIENCE

- Very enjoyable experience, with deep and at times heated conversations regarding how to best collect, processing, analyze, report, represent data/results for imaging.
  - Take a hard look at your methods
  - Communicate with colleagues at other sites
  - Share! And ask others for their assistance
  - Be willing to critique other methods and also have your approach critiqued (in person!)

- CDEs include imaging measures of tissue microstructure, functionality, and mobile amide protein concentrations

- CDEs include widely applied imaging methods (most novel modalities not included)

- Well characterized quantitative imaging methods not included in CDEs (e.g., T2, T2*, T1 known to reflect hemorrhage and edema)

- Use of a z-score normalization method may be highly effective in comparisons across sites.

- Coordination across sites may be subject to institutional administrative differences (e.g., IACUC approvals, etc) and personnel fluctuations