ADNI MRI Core Summary of Meeting for Protocol Selection

May 8, 2005

Miami, Florida

The ADNI MRI Core met in Miami on May 8. The purpose of this meeting was to review data which had been collected and analyzed during the preparatory phase, and come to a consensus on the construction of the MRI protocol that will be used for the execution phase of ADNI. The analysis plan for the preparatory phase contained seven specific aims. For a variety of reasons, most having to do with time pressure, the MRI Core had narrowed imaging sequences under consideration for the execution phase to the following: MPRAGE, SPGR, T1 synthetic images, and for the T2-weighted sequence a dual FSE and FLAIR were under consideration. The bulk of the discussion at the meeting centered on the appropriate imaging sequence or sequences to use for the 3D T1-weighted morphometry acquisition.

The introductory discussion focused on the over all form of the ADNI MRI protocol. It was noted that the duration of the patient scanning portion of the execution phase protocol had in previous discussions been targeted to approximately 30 minutes. This 30 minute limit was imposed in order to minimize patient burden and thus maximize patient retention. It was also noted that in order to avoid incurring additional costs for scanning the ADNI phantom as a separate weekly study on each scanner, the phantom scan could be coupled with the patient scan at each time point. The overall structure of

the ADNI MR execution phase protocol thus was targeted to 30 minutes of patient scan and 15 minutes of phantom scan time. This design conveniently accommodated two objectives, cost containment and more importantly minimization of subject burden. The 30 minutes of patient scan time could accommodate at most 3 imaging sequences.

When all the data gathered in the preparatory phase had been presented, it was clear that the results were mixed. There was no clear indication across the different analyses performed that one image type outperformed the other. In addition, where one image type was found to be better than another, differences were typically small. There was an overall consensus across the data presented that the MPRAGE and SPGR sequences outperformed the synthetic T1images, with the caveat that the synthetic T1 images had not necessarily been optimized for many of the types of analyses performed. The primary advantages of the SPGR over MPRAGE were superior SNR and superior performance on applications that placed a premium on brain-CSF segmentation. The advantages of the MPRAGE sequence were superior gray-white contrast and gray-white SNR, superior performance in some applications requiring cortical segmentation, and imaging times that were under ten minutes for all vendor platforms at both field strengths. A disadvantage of SPGR was imaging times at the specified special resolution which exceeded 10 minutes at 3T on two of the vendor platforms. The group also noted that SNR advantage for SPGR may have been to great extent present on head coil acquisitions at 1.5T with an older version of the prep phase protocol. The revised prep phase head coil 1.5T protocols contain modifications - reduced bandwidth and increased slice number - which resulted in significant improvement in the SNR.

After lengthy discussion, the group unanimously selected MPRAGE as the 3D sequence for the ADNI execution phase. The suggestion was also made to acquire back-to-back MPRAGE sequences as opposed to the more traditional approach of a single acquisition per exam. The advantage of incorporating back-to-back MPRAGE acquisitions as a standard feature of the protocol is that the decision to repeat the scan on the basis of image quality will not be placed in the hands of individual technicians performing the scans. ADNI will be in a position to select the better MPRAGE sequence at each time point based on centralized and standarized criteria. Perhaps most importantly, requiring back-to-back MPRAGE scans should reduce the number of examinations that must be repeated due to poor image quality. This in turn should minimize patient burden and enhance patient retention in the study. Finally, if both MPRAGE studies were of high quality, they could be combined to produce a single image with an improvement in SNR by the square root of two.

Discussion of the appropriate imaging sequence to employ for cerebral vascular disease detection centered on FLAIR vs dual fast spin echo. The 30 minutes allotted to patient scan time can accommodate at most 3 imaging sequences. After the group had decided on back-to-back MPRAGE sequences, a single additional sequence could be used for cerebral vascular disease detection and general clinical diagnosis. Although the FLAIR sequence is highly useful for automated quantitation of cerebral vascular disease and is also used by many sites for clinical diagnosis, consideration was given to how the ADNI protocol would mesh with the general mode of clinical practice. It was decided

that most clinical groups would find a dual-echo fast spin echo more in keeping with their general practice than a stand alone FLAIR image. The group therefore decided on the following for the final format of the ADNI execution phase protocol.

1. Standard prescan and scouting procedure recommended by the manufacturer.
2. MPRAGE #1
3. MPRAGE #2
4. Calibration scans for B_1 correction
5. Dual fast spin echo
6. Phantom scan using the same MPRAGE sequence employed for patient studies, but with 1.3mm slice thickness.