3rd Annual Research Symposium
HFMG Academic Affairs
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Abstract Deadline: March 24, 2006

Title: Subdural and Depth Electrode Placement in the Brain for Validation of MEG in Partial Epilepsy

a) Background & Objective
In this work, we propose the following steps to register all modalities of data into a single reference coordinate system in order to facilitate quantitative validations of the magnetoencephalography (MEG) analysis results: 1) Segmentation of subdural and depth electrodes, and cortical surface. 2) Building 3D models of the above segmented objects. 3) Registration of CT and MEG, into the preop MRI. The above steps result in fusion of all modalities of data, objects of interests (electrodes and cortical surface), MEG analysis results and brain mapping findings. This approach offers a means by which an accurate appreciation of the epileptogenic zones may be established through optimal visualization and further quantitative analyses of the noninvasive fused data.

b) Approaches
A reliable and accurate means of establishing the location of implanted electrodes with respect to cerebral surface topography is accomplished through the use of image registration of preop MR images with postop (post electrode implantation) CT images. We have used the scalp fiducial markers to estimate the transformation matrix in a least mean square error scheme. We have further aligned two dataset manually. The geometrical models of the objects of interests (i.e., cortical surface and electrodes) are generated through a segmentation step and utilization of the 3D slicer software. We have used the above tool to verify the MEG analysis results by the means of accurate EEG phase II mapping.

c) Conclusions & Results
The proposed method facilitates the validation of MEG analysis results by incorporating them into stereotactic image space accurately augmented with implanted subdural and depth electrodes. The subsequent electrocorticographic recording of cerebral activities will establish conclusively the location of ictal onset. The latter provides the ground truth for quantitative validation of MEG as well as any other fused (potentially noninvasive) diagnostic technique. The proposed approach eliminates the mental load of transferring the 2D views of the the images and electrodes to the actual 3D space, providing the experts with higher accuracy and more confidence.