PRECISE LOCALIZATION OF SUBDURAL ELECTRODES FROM CT AND MRI RECONTRUCTED BRAIN SURFACE - COMPARISON WITH INTRAOPERATIVE PHOTOGRAPHS

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Objective: Accurate localization of intracranial EGG electrodes is required for epilepsy surgery planning, but due to the brain shift caused by skull opening this task is not trivial. To evaluate a precision of minimal cost function based method for subdural electrode reconstruction we compared this method with intraoperational digital photography.
Methods: Seven patients with medically resistant epilepsy were implanted with subdural electrodes to determine most probable location of seizure origin. Electrodes were localized on postimplantation high resolution CT using custom Matlab script and their location was visually verified by two reviewers. FSL bet tool was used to extract brain surface from preimplantation MRI and a custom Matlab script, based on cost function minimization, was then run to reconstruction electrodes' position the extracted brain surface.
Operative photographs were then matched to the MRI reconstructed brain with surface-projected electrodes using common structural properties - mainly sulci and vasculature. Center-to-center distances between projected and photographed electrodes were then calculated. A mean of pairs of adjacent electrodes with a known distance of 1 cm was used to determine scale.
Results: 276 electrodes were identified on both digital photography and reconstructed brain surface. Mean electrode distance for reconstructed to photographed electrode was 5.8 mm with minimum distance of 0.2 mm and maximum distance of 16.2 mm.
Conclusion: A electrode reconstruction method based on minimization of cost function provides fast and reliable localization of intracranial electrodes.