The application of 3D EEG/MRI epileptic focus localization in 20 year old girl with bilateral ictal and interictal discharges

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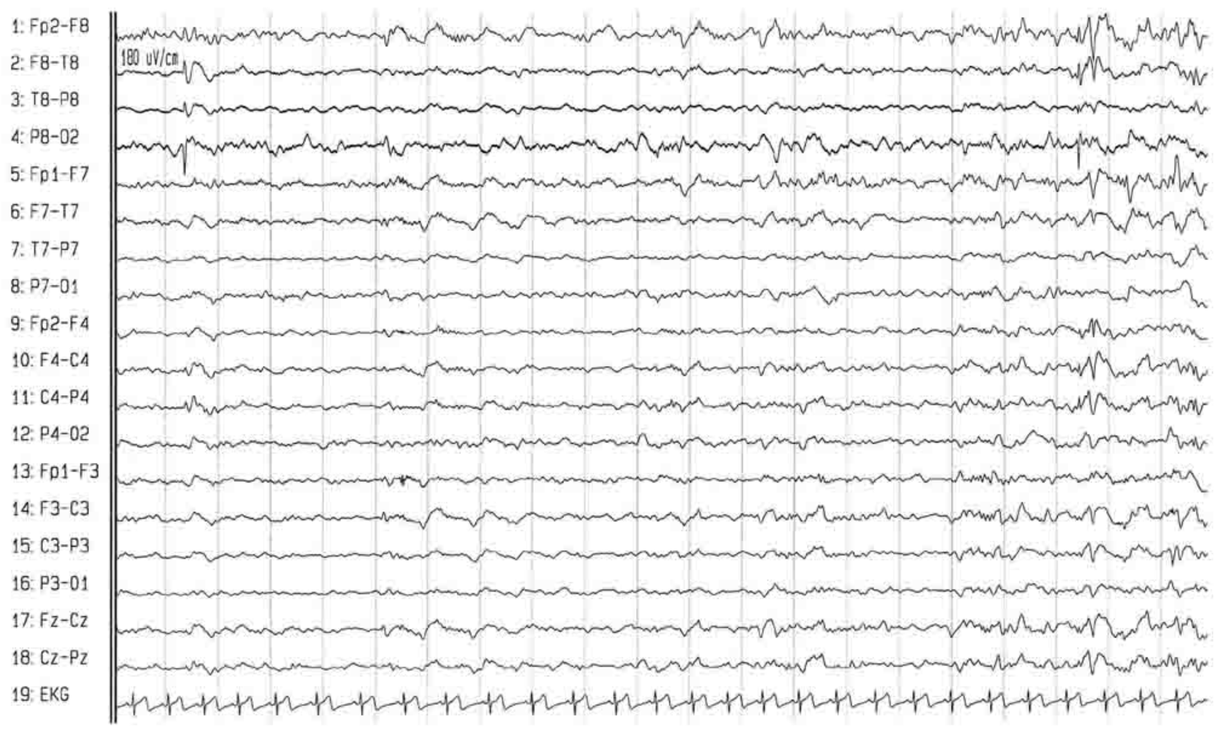
PURPOSE: To present an application of a new, noninvasive method of 3D EEG/MRI epileptic focus localization in presurgical diagnostics.

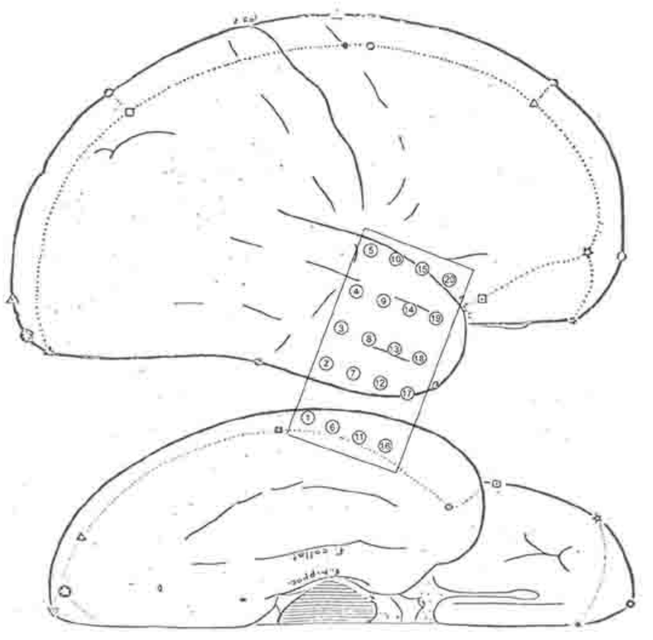
METHODS AND MATERIALS: 20-year old girl suffering for 8 years from drug-resistant focal epilepsy with very frequent (even 10 auras a day, and complex seizures with stereotyped automatisms several times monthly) seizures of temporal semiology was investigated for surgical procedure. No neurological abnormality was found. Magnetic resonance imaging (MRI) performed on age 15, 17 and 20 respectively, were normal, except impression of increased volume of right temporal horn of lateral ventricule, after first examination. Several ictal video-recordings were not conclusive, showing bilateral discharges in fronto-temporal regions, with only two of them pointing clearly to the right temporal seizures origin. To specify the localization of epileptic focus the 64 channel long term EEG was acquired with sampling frequency of 250 Hz and 16 bit resolution. The 3D image of brain was generated on the basis of MRI single slices with thickness about 1,4 mm. The surface of the cortex of the brain and the skin were separated from the whole image after semiautomatic segmentation procedure . Next the coordinates of EEG electrodes were fitted to the image of the surface of cortex. The last step was the generation of 3D potential map on the surface of the cortex using spherical spline method. 3D images and the series of images showing discharges were reviewed on the computer.

RESULTS: The 3D maps showed primary focus in right temporal region with discharges propagation from T6 to T4 and F8 electrode sites. ECoG before resection displayed frequent spiking involving anterior and basal part of right temporal lobe. The operation was performed : right temporal lobectomy - tailored anterior resection: 6 cm to 7 cm from the tip with 2.5 cm hippocampal resection. ECoG after temporal lobe resection revealed infrequent spikes behind temporal resection cavity. Pathology of temporal lobe was found: hippocampus - gliosis, neuron loss and dark neurons – hippocampus sclerosis suspected; temporal lobe cortex - severe gliosis with dark neurons. Since the operation patient remains seizure free for one year.

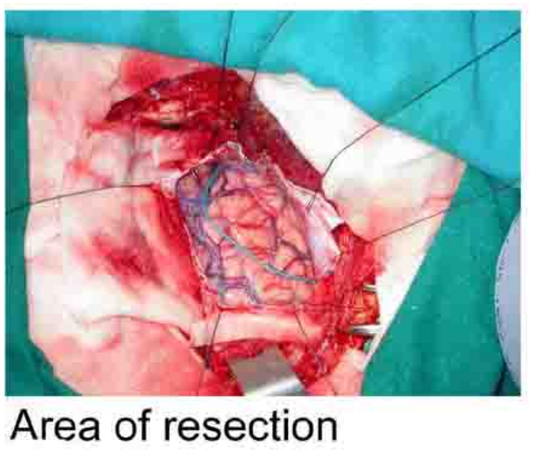
CONCLUSIONS: The above noninvasive method seems to be a good alternative for invasive presurgical investigation in epileptic patients in cases with focus localization difficulties.



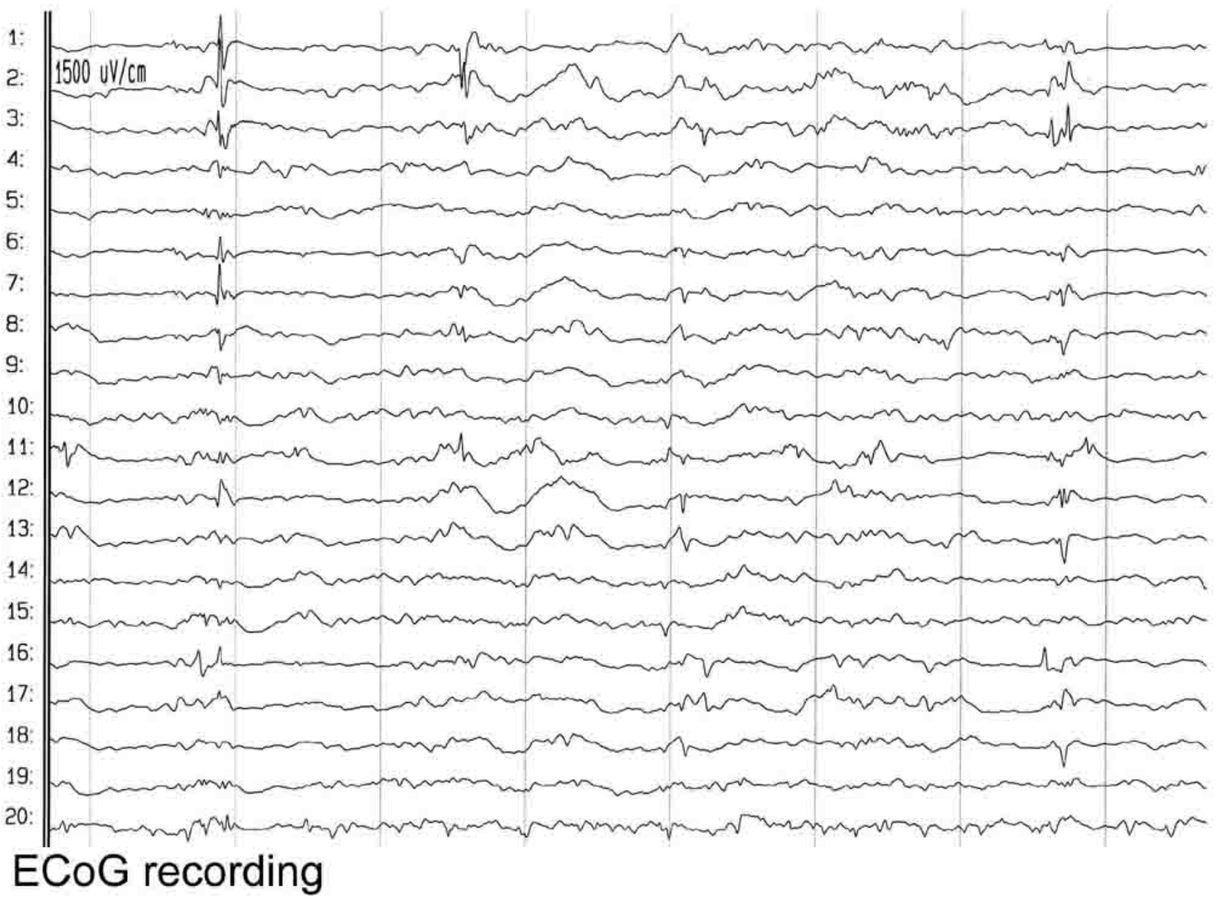
Onset of ictal EEG



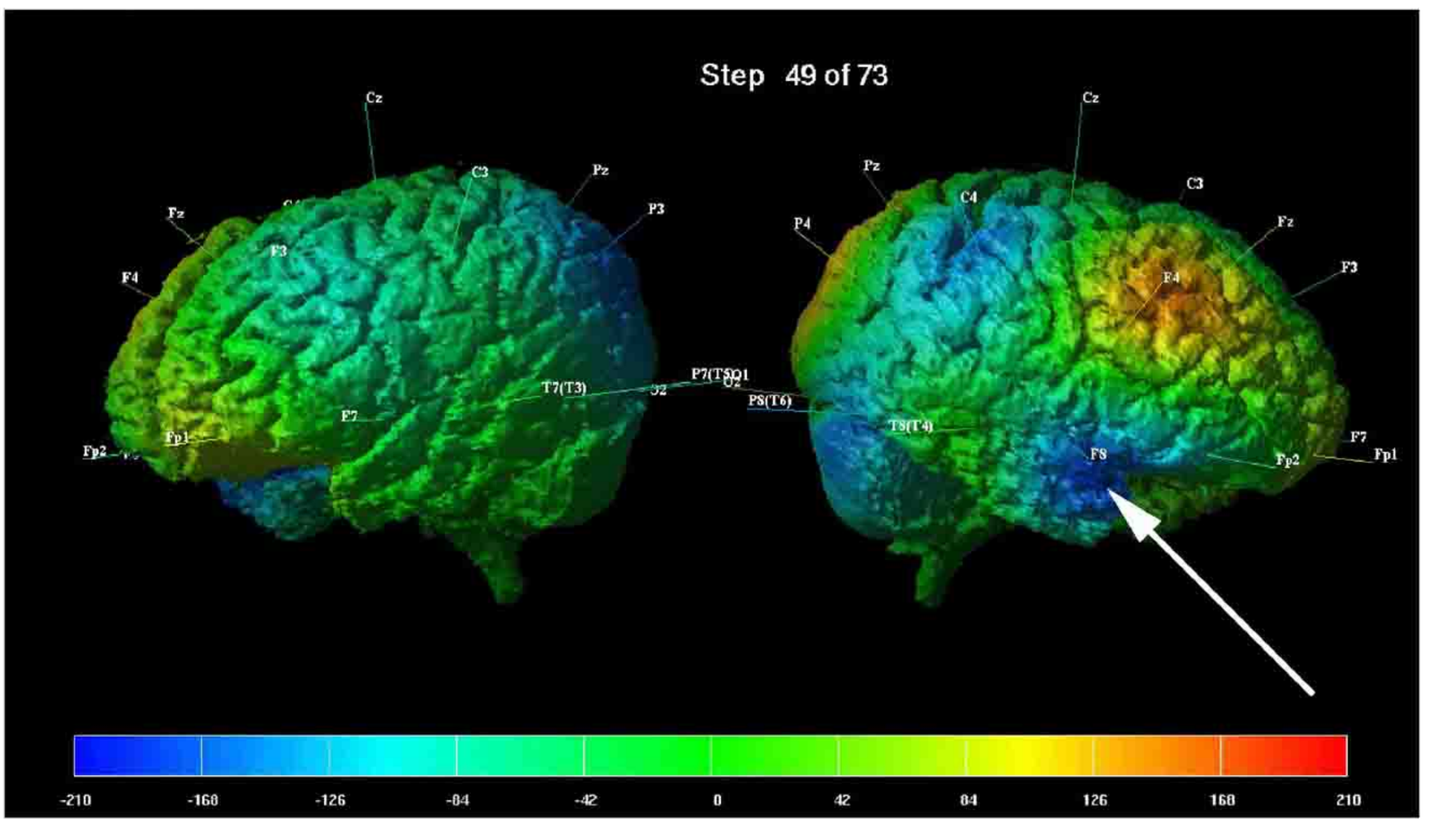
ECoG electrodes net



Area of resection



ECoG recording



3D image of ictal discharge

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