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Comparison of SPECT intensity features and MRI volume measures for lateralization in temporal lobe epilepsy

Kourosh Jafari-Khouzani,[a] Hamid Soltanian-Zadeh,[a,b] Kost Elisevich[c]
[a] Department of Diagnostic Radiology, Henry Ford Hospital, Detroit, Michigan, USA
[b] Control and Intelligent Processing Center of Excellence, ECE Department, University of Tehran, Tehran, Iran
[c]Neurosurgery Dept., Henry Ford Health System, Detroit, Michigan, USA

Background & Objective: Lateralization of the seizure focus is an important task in the pre-operative evaluations for the epileptic patients who are candidate for surgery. The purpose of this study was to compare the SPECT intensity features and MRI volumetric measurements for localizing the epileptic focus in a population of patients with mesial temporal lobe epilepsy (mTLE).

Experimental Approaches: We retrospectively selected 38 patients (17 males, 21 females; 20 left sided, 18 right sided, age range 20-61, mean 40) with mTLE who had preoperative T1-weighted (T1W) MRI as well as ictal and interictal SPECT scans. Lateralization was performed based on video-electroencephalography or extraoperative ECoG. Ictal and interictal SPECT images were separately co-registered to the T1W image using rigid co-registration technique. The intensities of the two SPECT images were matched using an L_1 norm minimization technique. Ictal-interictal subtraction (SISCOM) was then generated. T1W image was segmented into multiple structures using an atlas-based segmentation technique. Mean and standard deviation of the ictal-interictal subtraction intensities were calculated for the hippocampus as well as the entire temporal lobe. The mean intensity difference and the ratio of the standard deviations of the left and right sides were calculated for each patient. We used a linear classifier to distinguish between the left-sided and right-sided patients. The ratio of the left and right hippocampi volumes was evaluated separately.

Results: Combination of the mean and standard deviation of the ictal-interictal subtraction for the hippocampus was concordant with intracranial ECoG in 92.1% of the patients whereas they individually resulted in 84.2% and 68.4% accuracy, respectively. Combination of the mean and standard deviation for the whole temporal lobe resulted in 89.5% accuracy. The volumetric analysis was concordant with intracranial ECoG in 84.2% of the patients.

Conclusions: SISCOM analysis of the hippocampi is more sensitive in lateralization of the mTLE patients compared with SISCOM analysis of the whole temporal lobe as well as volumetric analysis of the hippocampus.

Person to whom correspondence to be directed:

Name:	Kourosh Jafari-Khouzani
E-Mail:	kjafari@rad.hfh.edu
Department/Division:	Diagnostic Radiology
Phone Number:	313-874-4378
Fax Number:	313-874-4494