Amygdala Asymmetric Damage Increases with the Duration of Epilepsy

P. M. Gonçalves Pereira[1,2], E. Oliveira[3], M. F. Secca[4,5]

[1]Dpt. of Medical Science, University of Beira Interior, Covilha, Portugal, [2]Dpt. of Neurorradiology, Hospital Egas Moniz, Lisboa, Portugal, [3]Dpt. of Statistics, Health Science Institute (ISCS), Lisboa, Portugal, [4]Dpt. of Physics, University Nova de Lisboa, Lisboa, Portugal, [5]"Caselas" Magnetic Resonance Center, Lisboa, Portugal

Abstract

Several lines of evidence suggest that amygdala damage in temporal lobe epilepsy is asymmetrically bilateral. The factors underlying such asymmetries are relatively unexplored. This study correlates the asymmetry index of amygdala volumetry, relaxometry and ADC-mapping with the duration of epilepsy. Results show significant correlations between structural asymmetries and the duration of seizure disorder. Although these findings do not discard the possibility that a certain degree of unilateral damage can be present at the beginning of the disease, this cross-sectional multimodal MRI analysis of amygdala pathology agrees with our previous findings on the hippocampus, and suggests that asymmetrical damage is progressive.

Introduction

In human temporal lobe epilepsy (TLE) associated with hippocampal sclerosis, the amygadala is an important source of seizures as demonstrated by invasive electrophysiological data [1]. A number of cross-sectional studies have shown that amygdala damage is associated with the progressive and intractable nature of TLE [2] and that a minority of patients can present isolated amygdala sclerosis [3]. Quantitative MRI (qMRI) analyses in TLE have shown unilateral atrophy and prolonged T2 relaxation times with varying degrees of asymmetry [2, 4]. While previous reports have suggested a variety of factors that may be associated with the presence of amygdala damage, including a history of complex or prolonged febrile seizures, age at seizure onset, and epilepsy duration, the clinical correlations that may determine the course of development of pathological asymmetries are relatively undefined. In order to verify the relation between the amygdala asymmetry index (AI) and the duration of symptomatic TLE, we performed a cross-sectional study where the AI of amygdala volumes (AMYVOL), T2-relaxometry (AMYT2) and ADC-mapping (AMYADC) were correlated with the duration of the seizure disorder in years, in a group of patients under pre-surgical evaluation.

Methods

73 chronic adult TLE patients and 34 age-matched controls were included. Patients with lesional pathology and visible heterotopic abnormalities were excluded. Duration of epilepsy for each patient was calculated from the beginning of the repetitive episodes of spontaneous seizures unprovoked by an acute illness. Data was obtained by reviewing the medical records from the local surgery for epilepsy programme and calculated accordingly to the formula:

Duration (years) = age at neuro-MRI - age at development of spontaneous seizures

All MRI images were obtained on a 1.5T Signa CV/i-NV/i (GE); qMRI data (Figure 1) was acquired and processed as described [5, 6]. Only a subset of patients (n=45) underwent diffusion studies. AI for AMYVOL, AMYT2 and AMYADC were calculated using the formula, were R refers to the right side and L to the left:

$$AI = 100 \times [(R-L)/(R+L)/2]$$

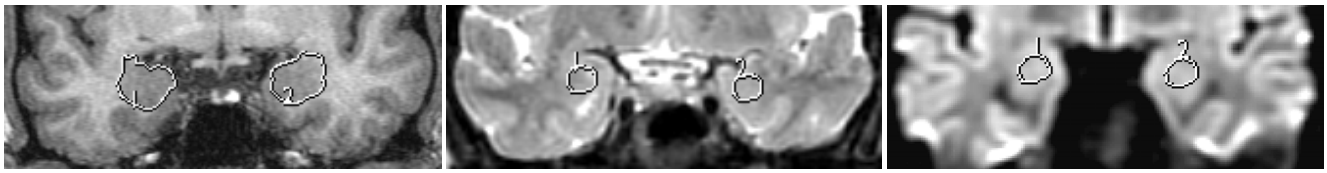

Figure 1: Amygdala volumetry, T2-relaxometry and ADC maps.

Results

The mean AMYVOL, AMYT2 and AMYADC ipsilateral to the seizure focus differed significantly between controls and TLE patients. As shown in Figure 2, the longer the duration of epilepsy, the greater are the structural asymmetries in-between amygdalae.

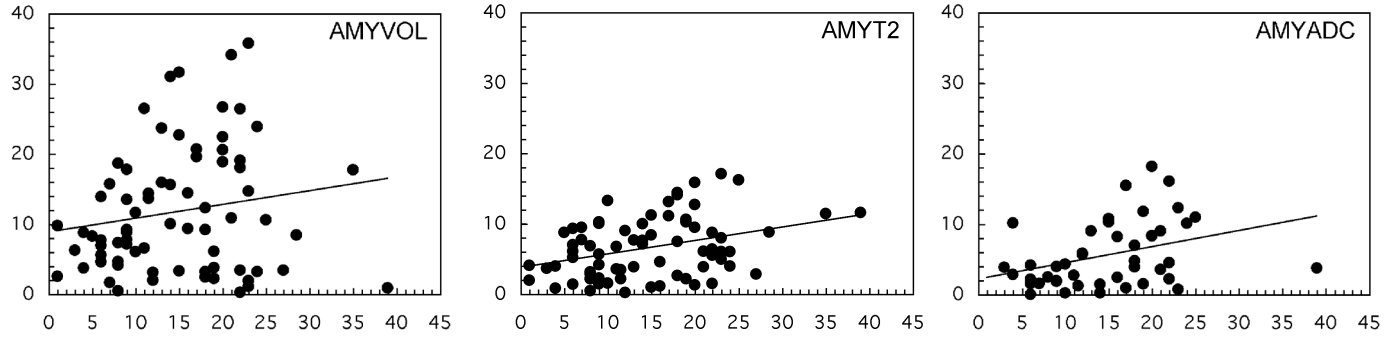

Figure 2: Pearson's correlations between years of epilepsy (*x*-axis) and AIs (*y*-axis) for AMYT2 (n=73, r=0.35, p<0.01) and AMYADC (n=45, r=0.36, p<0.05). No significant correlation was found with AMYVOL (n=73, r=0.17, p>0.05).

Discussion

The present data agrees with our previous findings on the hippocampus [7], except for AMYVOL. The absence of correlation with the volume suggests that T2-relaxometry and ADC-mapping are more specific surrogate markers for amygdala pathology. Although these findings do not discard the possibility that a certain degree of unilateral damage can be present at the beginning of the disease, this cross-sectional qMRI multimodal analysis of amygdala pathology suggests that asymmetrical damage progresses over time.

References

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