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Research report

Neuro-anatomical differences among epileptic and non-epileptic déjà-vu

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ABSTRACT

Objective: Dèjà-vù (DV) can occur as a seizure of mesial temporal lobe epilepsy (MTLE) and in almost 80% of healthy individuals. The remarkable similarity between epileptic DV and DV in healthy individuals raises the possibility that DV might sometimes be an ictal phenomenon in apparently normal individuals. Thus, we studied a group of healthy subjects versus individuals with benign MTLE (bMTLE) both experiencing DV.

Methods: 63 individuals with epilepsy patients with bMTLE and 39 healthy controls at Catanzaro University were recruited. Participants completed the Inventory for Déjà Vu (DV) Experiences Assessment (IDEA) test, underwent awake and asleep electroencephalogram, MRI of the brain using a 3T scanner and whole brain voxel-based morphometry (VBM). bMTLE patients with DV and without DV were also matched for the presence of hippocampal sclerosis.

Results: Our controls had no history of neurological or psychiatric illness, epilepsy or history of febrile convulsions. Neurological and cognitive examinations were normal. Electroencephalographic procedures were unremarkable in all controls. In bMTLE group, the direct comparison of VBM between individuals with epilepsy with DV versus those without DV revealed abnormal anatomical changes in the left hippocampus, parahippocampal gyrus and visual cortex. The VBM of healthy controls with DV showed abnormal anatomical changes only in the left insular cortex.

Conclusions: Our VBM results demonstrated different morphologic patterns in individuals with epilepsy and control subjects experiencing DV, involving the memory circuit in bMTLE patients and cerebral regions in the emotional network in healthy controls.

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1. Introduction

Déjà vu (DV) is a transitory mental state of incongruous impression of familiarity of present experience with an undefined past. Although almost 80% of healthy individuals have experienced DV at once in their lives (Brázdil et al., 2012), this fascinating phenomenon is also very often present in patients with mesial temporal lobe epilepsy (MTLE) mainly with familial trend (Gambardella et al., 2000). To date, it is already very well known that epileptic illusions of DV are ictal manifestations arising from discharge within either mesial or lateral temporal cortex (Bancaud, Brunet-Bourgin, Chauvel, & Halgren, 1994) whereas anatomical basis for DV in healthy subjects is less delineated and interpreted.

Very recently, Brazdil and coworkers (Brázdil et al., 2012) described for the first time the anatomical correlates associated with DV in healthy population, illustrating volumetric differences in several brain regions involving predominantly mesio-temporal regions where the loss of gray matter was significant. Very interestingly, the present author found the same well-known epileptic network (Hippocampus-Thamalus-Basal Ganglia) involved in the genesis of refractory MTLE together with critical brain areas involved in the limbic system (Amygdala, Orbitofrontal cortex and insular cortex) (Bonilha et al., 2004; Catani et al., 2012; Labate et al., 2010). These epileptic networks have also been extensively described in patients with milder form of sporadic MTLE called benign MTLE (bMTLE), which is characterized by seizure onset in adulthood, frequent familial history and simple partial epileptic DV that often represents the only predominant ictal symptom (Labate et al., 2010; Labate, Cerasa, Gambardella, Aguglia, & Quattrone, 2008; Labate et al., 2011).

Fascinatingly, the remarkable similarity between DV as an epileptic phenomenon and DV observed in healthy individuals, and the observation in patients with bMTLE that the DV experience often represents the only type of seizure, raises the possibility that DV itself might sometimes be an ictal phenomenon in apparently normal individuals, and could represent the mildest manifestation on the TLE phenotype as proposed by Brazdil et al. (Brázdil et al., 2012). Thus, we thought and proposed (Labate & Gambardella, 2013) an attempt to clarify whether there are some structural/morphologic differences between healthy subjects and individuals with bMTLE both suffering from DV.

2. Materials and methods

2.1. *Demographic features*

Demographic features of our population are summarized in Table 1. The research ethic committee approved this study and written informed consent was obtained from all participants. From May 2012 to May 2013, we prospectively recruited four groups of participants from the University of Catanzaro, Italy: 32 bMTLE patients with DV (21 women, mean age 37.0 ± 11, range 20–57 years); 31 bMTLE patients without DV (20 women, mean age 38.6 ± 10, range 23–60 years); 22 healthy controls with DV (14 women, mean age 33.7 ± 8.6, range 20–49 years) and 17 healthy controls without DV (eight women, mean age 34.7 ± 8.4, range 27–49 years). The healthy controls were all volunteers who were enrolled from the staff of our University in Catanzaro among university students, paramedics and doctors. Ninety healthy volunteers were interviewed, and 39 (22 with DV and 17 without DV) agreed to participate at the study and undergo brain MRI evaluation. Healthy controls were selected based on lack of history of febrile seizures, epilepsy or abnormal neurological examination. Importantly, much attention was paid to check for the presence of hippocampal sclerosis among the patients with epilepsy since there is a large amount of evidence that this specific neuroradiological sign is associated with hippocampal atrophy in bMTLE patients.

The diagnosis of bMTLE was made according to current accepted features (Labate et al., 2011). Any suggestion of seizure onset outside the mesial temporal structures, by semiology or EEG findings, or patients with refractory TLE, led to exclusion from the study. The only accepted MRI sign was hippocampal sclerosis, which was based on the characteristic MRI pattern of abnormalities because it is a finding often observed in bMTLE (Labate et al. 2006). None of the patients had mental retardation.

Table 1 – Features of bMTLE DV and non-DV compared to healthy control.

Features	bMTLE DV	bMTLE non-DV	Healthy controls DV	Healthy controls non-DV	*p* Value
Number	32	31	22	17	
Sex (%)	62% Female	62% Female	63% Female	47% Female	.674[a]
Age (y)	37.0 ± 10.9 yr (20–57)	38.6 ± 10.3 yr (23–60)	33.5 ± 7.9 yr (20–49)	34.8 ± 7.94 yr (27–49)	.34[b]
Age at onset of epilepsy (y)	21 ± 13.7 yr (2–49)	22.8 ± 13.8 yr (1–55)	/	/	.59[c]
Duration of epilepsy (y)	15 ± 12.4 yr (1–42)	15.2 ± 11.6 yr (1–42)	/	/	.92[c]
Family history of FC/epilepsy	14 (43.7%)	11 (35.4%)	0	0	.6[a]
Antecedent FCs	6 (18.7%)	6 (19.3%)	0	0	.79[a]
Hippocampal sclerosis on MRI (%)	10 (33%)	10 (32%)	0	0	.85[a]
Ictal EEG *n* (%)	4 (12.5%)	4 (12.9%)	0	0	.74[a]
Interictal Pathological EEG (%)	22 (68.7%)	21 (67.7%)	0	0	.85[a]

bMTLE: benign mesial-temporal lobe epilepsy; DV: déjà vu; FC: febrile convulsions.
[a] χ^2 test.
[b] one-way ANOVA.
[c] unpaired *t* test.

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