Epilepsy & Behavior 62 (2016) 104–114

Contents lists available at ScienceDirect

Epilepsy & Behavior

journal homepage: www.elsevier.com/locate/yebeh

Occipital and occipital "plus" epilepsies: A study of involved epileptogenic networks through SEEG quantification

Angela Marchi [a,b], Francesca Bonini [a,b], Stanislas Lagarde [a,b], Aileen McGonigal [a,b], Martine Gavaret [a,b], Didier Scavarda [c], Romain Carron [d], Sandrine Aubert [a], Nathalie Villeneuve [a], Samuel Médina Villalon [a], Christian Bénar [b], Agnes Trebuchon [a,b], Fabrice Bartolomei [a,b,*]

[a] APHM, Timone Hospital, Clinical Neurophysiology and Epileptology Department, Marseille 13005, France
[b] Aix-Marseille Université, Institut de Neuroscience des Systèmes, UMR_S 1106, Marseille 13005, France
[c] APHM, Timone Hospital, Paediatric Neurosurgery Department, Marseille 13005, France
[d] APHM, Timone Hospital, Functional and Stereotactical Neurosurgery Department, Marseille 13005, France

ARTICLE INFO

Article history:
Received 19 March 2016
Revised 14 May 2016
Accepted 16 June 2016
Available online xxxx

Keywords:
Occipital lobe
Focal epilepsy
Epilepsy surgery
Epileptogenicity index

ABSTRACT

Compared with temporal or frontal lobe epilepsies, the occipital lobe epilepsies (OLE) remain poorly characterized. In this study, we aimed at classifying the ictal networks involving OLE and investigated clinical features of the OLE network subtypes. We studied 194 seizures from 29 consecutive patients presenting with OLE and investigated by stereoelectroencephalography (SEEG). Epileptogenicity of occipital and extraoccipital regions was quantified according to the 'epileptogenicity index' (EI) method. We found that 79% of patients showed widespread epileptogenic zone organization, involving parietal or temporal regions in addition to the occipital lobe. Two main groups of epileptogenic zone organization within occipital lobe seizures were identified: a pure occipital group and an occipital "plus" group, the latter including two further subgroups, occipitotemporal and occipitoparietal. In 29% of patients, the epileptogenic zone was found to have a bilateral organization. The most epileptogenic structure was the fusiform gyrus (mean EI: 0.53). Surgery was proposed in 18/29 patients, leading to seizure freedom in 55% (Engel Class I). Results suggest that, in patient candidates for surgery, the majority of cases are characterized by complex organization of the EZ, corresponding to the occipital plus group.

1. Introduction

Occipital lobe epilepsies (OLE) are rare (1–8% of epilepsy surgery series) [1–4] and challenging. The reported success rate of surgery is lower compared with that of temporal lobe epilepsy and may range from 25 to 90% [4–7] depending on studies. There are relatively few studies of homogeneous surgical populations with OLE, particularly involving invasive recordings [4,7–15]. Indeed, as most of the anatomical borders in the posterior cortex are almost arbitrary, some authors have studied OLE in the context of posterior cortex epilepsies (PCE), encompassing a group of epilepsies originating from the occipital, parietal, and posterior–temporal lobes [5,16–18]. Furthermore, most series on OLE refer only to patients who have undergone epilepsy surgery, thus potentially limited to a subset of patients with a more focal form within the larger clinical spectrum of OLE. Most of the occipital cortex is buried, and its high connectivity facilitates rapid and widespread propagation of an epileptic discharge. These intrinsic characteristics hinder identification and localization of focal epileptiform abnormalities using scalp electrodes. Therefore, a noninvasive presurgical assessment of OLE is often not sufficient to precisely define the epileptogenic zone (EZ) (region of primary organization of ictal discharge). In addition, the EZ often extends beyond the epileptogenic lesion [11,18,19]. Thus, invasive recordings with stereoelectroencephalography (SEEG) might be needed, including those in lesional cases. Attempts to classify occipital lobe seizures on anatomical or anatomoclinical grounds have been performed in the past. Within occipital seizures, some authors have distinguished mesial versus lateral types, occipital versus occipitotemporal types, or occipital versus occipital plus types, basing such classification on clinical features, scalp-EEG features, seizure spread on invasive EEG, or surgical outcome [1,3,6,8,13,20].

From a functional standpoint, an anatomical definition of occipital seizures as entities confined within the occipital lobe boundaries will be inevitably unsatisfactory. Indeed, epileptic seizures, as a pathological but dynamic event, follow existing integrated neural pathways not limited by classical anatomic boundaries.

In this study, we aimed at delineating the organization of neural networks of seizures arising from the occipital lobe, using SEEG recordings. In particular, we intended to determine whether subgroups of OLE

* Corresponding author at: Service de Neurophysiologie Clinique, CHU Timone, 264 Rue Saint-Pierre, 13005 Marseille, France. Tel.: +33 491385833; fax: +33 491385826.
E-mail address: fabrice.bartolomei@ap-hm.fr (F. Bartolomei).

http://dx.doi.org/10.1016/j.yebeh.2016.06.014
1525-5050/

Table 1
Main clinical features of the studied population. Abbreviations: F = female; M = male; N = no; Y = yes; DNET = dysembryoplastic neuroepithelial tumor; FCD = focal cortical dysplasia; HME = hemimegalencephaly; L = left; R = right; GK = gamma-knife; B = bilateral epileptogenic zone organization; EZ = epileptogenic zone; SVH = simple visual hallucination; CVH = complex visual hallucination.

Patient	Sex	Age at onset (year)	Age at recordings (year)	Etiology	Side of EZ	Aura	Subtype	Surgery	Follow-up (year)	Engel Class
1	F	8	17	FCD	R	1. Amaurosis 2. SVH (vision of a moved image)	Occipital pure	Y	9	I
2	F	21	30	Heterotopia	B	1. SVH 2. déjà-vu/déjà vecu/taste or smell	Occipital pure	N	–	–
3	F	10	15	Heterotopia	L	SVH (multicolored ball moving over the upper quadrant of CVH)	Occipitotemporal	N	–	–
4	F	5	7	HME	L	Fear	Occipital pure	Y	2	IA
5	M	2	29	Surgical scar	B	1. SVH (flashing lights over the inferior quadrant of CVH) 2. Visual illusion (dyschromatopsia)	Occipitoparietal	Y	6	III
6	M	18	24	Heterotopia/polymicrogyria	R	1. Thoracic pressure-like sensation/nausea/déjà-vu/déjà vecu 2. Blurring vision	Occipital pure	Y	0,5	IA
7	M	0.66	7	FCD	R	Not reported	Occipital pure	Y	1	IA
8	M	7	15	DNET	R	1. SVH (unformed vision) 2. CVH (cars of videogame)/visual illusion (room moving from R to L) 3. Fear	Occipitoparietal	Y	3	IA
9	F	5	19	FCD	B (R)	1. SVH (colored bright ball) 2. Visual illusion (loss of stereoscopic vision) 3. Feeling of estrangement/depersonalization	Occipitoparietal	N	–	–
10	M	18	49	Polymicrogyria/double cortex	R	1. Blurred vision 2. SVH (black spots moving from contralateral to ipsilateral hemifield) 3. Feeling of being moved to the right side 4. Feeling of warmth	Occipitotemporal	N	–	–
11	F	6	15	Cryptogenic	B (R)	Amaurosis	Occipitoparietal	Y	9	II
12	M	3	25	FCD	R	1. Blurred vision 2. Visual illusion (objects around him moving)	Occipitotemporal	Y	2	III
13	F	11	25	Dilatation ventricular occipital horn	R	1. Blurred vision 2. Vertigo/somatosensory (sensation of limpness right arm) 3. Feeling of eyes being pulled to the right	Occipitoparietal	N	–	–
14	F	2.5	50	Prenatal ischemic sequel	B	SVH (stars over contralateral visual hemifield)	Occipitoparietal	Y	12	IV
15	F	1.5	21	FCD	L	Feeling of emptiness	Occipitotemporal	GK	7	IV

(continued on next page)