Epilepsy Research 125 (2016) 58–61

Contents lists available at www.sciencedirect.com

Epilepsy Research

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

Short communication

Ictal unilateral blinking is an unreliable lateralizing sign in tuberous sclerosis complex

Trupti Jadhav[a], Catherine Bailey[a], Wirginia Maixner[c,d], A. Simon Harvey[a,b,d,*]

[a] Department of Neurology, The Royal Children's Hospital, Melbourne, Australia
[b] Department of Paediatrics, The University of Melbourne, Melbourne, Australia
[c] Department of Neurosurgery, The Royal Children's Hospital, Melbourne, Australia
[d] Neurosciences Group, Murdoch Childrens Research Institute, Melbourne, Australia

ARTICLE INFO

Article history:
Received 2 March 2016
Received in revised form 29 May 2016
Accepted 24 June 2016
Available online 25 June 2016

Keywords:
Tuberous sclerosis complex
Unilateral blinking
Seizure semiology
Epilepsy surgery

ABSTRACT

Objective: Ictal unilateral blinking is an uncommon but reportedly reliable lateralizing sign, indicating an ipsilateral seizure focus. We aimed to determine its lateralizing utility in patients with tuberous sclerosis complex (TSC).
Methods: We reviewed the video-EEGs of 92 children with TSC and drug-resistant epilepsy. Eleven (12%) had seizures with unilateral blinking, of which 10 underwent epilepsy surgery. Lateralization of seizures was inferred from other semiology, ictal scalp EEG and outcome following tuberectomy.
Results: Seizures manifesting with unilateral blinking were focal motor in four patients, focal motor evolving into epileptic spasms in six, and epileptic spasms with focal features in one. Associated unilateral facial contraction was seen in five patients and arm jerking in four. Lateralized scalp ictal rhythms were seen in seven patients. Following tuberectomies, seven patients are seizure free and two had >90% reduction. Overall lateralization of seizures with unilateral blinking was contralateral in six patients and ipsilateral in four. When unilateral blinking was early in seizures, overall lateralization was more often contralateral (6/7 patients, PPV 85%).
Significance: Ictal unilateral blinking is not infrequent but unreliable in lateralizing seizures in TSC. Unrecognized seizure propagation to contralateral symptomatogenic regions and potentially different mechanisms may account for the variable lateralization.

1. Introduction

Ictal unilateral blinking is an uncommon but reportedly reliable sign, indicating an ipsilateral focus (Benbadis et al., 1996). Having observed unilateral blinking often during seizures in children with tuberous sclerosis complex (TSC), we sought to determine its utility in TSC.

2. Methods

We reviewed the clinical, EEG, MRI and surgical data in children with TSC and drug-resistant epilepsy evaluated at our center between 1997 and 2013. Videos of patients whose video-EEG monitoring (VEM) reported 'blinking', 'eyelid/eye blinks' or 'eyelid twitching' were reviewed, blind to localization of their EEG, tubers and surgery. Only patients with clear ictal unilateral blinking were included. Other focal motor semiology, ictal scalp EEG and post-operative seizure outcome were used to infer lateralization of seizures to the ipsilateral or contralateral hemisphere.

3. Results

Ictal blinking was reported in 20/92 TSC patients who underwent VEM. Eleven (12%) had clear unilateral ictal blinking, of whom 10 underwent tuberectomy and are the basis of this report.

The 10 patients (6 males) were aged 1.9–18 years (mean 10) during VEM. All had multiple bilateral tubers. Findings from VEM and surgery are summarized in Table 1.

3.1. Semiology of seizures with unilateral blinking

Eight patients had a single seizure type and two had multiple independent seizure types. Three seizure patterns were associated

* Corresponding author at: Department of Neurology, Royal Children's Hospital, 50 Flemington Road, Parkville, Victoria 3052, Australia.
E-mail address: simon.harvey@rch.org.au (A.S. Harvey).

http://dx.doi.org/10.1016/j.eplepsyres.2016.06.006
0920-1211/

with unilateral blinking: i) focal motor (4 patients), ii) focal evolving into epileptic spasms (6 patients) and iii) epileptic spasms with focal features (1 patient). Unilateral blinking was noted early during seizures in six patients, with or without progression to spasms. Blinking was rhythmic, regular and a prominent feature of seizures in all patients. The blinks were of a 'winking' (eyelid closure with minimal orbicularis oculi contraction) nature in nine patients and more forceful 'clonic jerking' of the orbicularis oculi in one.

Blinking was associated with unilateral facial contraction or jerking in five patients, being ipsilateral in two and contralateral in three. Tonic posturing or clonic jerking of one arm occurred in four patients, ipsilateral to blinking in three. Head and eye version occurred in five patients, ipsilateral to blinking in four. Focal features during spasms were noted in five patients, with prominent unilateral head/eye movement, arm/shoulder jerking, or contraction of the mentalis muscle (chin). One patient (patient 9) had unilateral blinking as a solitary manifestation of seizures, in addition to other seizure types, with and without unilateral blinking.

Hemispheric lateralization of seizures was inferred in patients with unilateral face or arm involvement, to the contralateral cerebral hemisphere. Thus, the seizure focus for unilateral blinking was ipsilateral in three patients, contralateral in five and undetermined in two (Table 2).

3.2. Ictal EEG during seizures with unilateral blinking

The scalp ictal EEG during seizures with unilateral blinking was a lateralized and relatively localized ictal rhythm in seven patients. In these patients, unilateral blinking occurred early in the seizure (within 10 s of clinical seizure onset) and the ictal rhythm remained localized during unilateral blinking, before spreading contralaterally in one patient and bilaterally in two. In patients 7 and 8, unilateral blinking occurred late in the seizure, preceding or as part of epileptic spasms, and the ictal EEGs were lateralized in some seizures; most seizures showed bilateral epileptic activity during the spasms with late unilateral blinking. In patient 9, the ictal EEG showed bilateral paroxysms during focal seizures with unilateral blinking and spasms, and no ictal EEG change during seizures with isolated unilateral blinking.

Based on the lateralization of scalp EEG onset, blinking was contralateral in five patients, ipsilateral in two and probably ipsilateral in two (Table 2). Scalp ictal EEG onset localized to the temporal region in three patients, frontal in two and centro-parietal in two.

Intracranial EEG (iEEG) monitoring with bilateral strip, grid and depth electrodes was performed in three patients. Lateralization of iEEG onset in seizures with unilateral blinking was contralateral to blinking in patient 3, right sided blinking being synchronous with onset in a left insula-temporal tuber complex. In patient 8, iEEG onset was ipsilateral to blinking, right sided blinking being syn-

Table 1
Electroclinical characteristics of seizures and surgery details in 10 patients with tuberous sclerosis complex and ictal unilateral blinking.

Pt	Seizure semiology	Scalp ictal EEG	Tubers resected (number)	Seizure outcome
1	Focal motor to spasms: Altered facial expression and **L blinking** → focal spasms with L version and L arm tonic	R centro-parietal rhythm* → spasm complexes# with R sided emphasis	R posterior frontal (1)	seizure free
2	Focal motor: Behavioral arrest → **L blinking** → L arm clonic → post-ictal L eyelid/arm weakness	L anterior frontal rhythm → R central rhythm*	Op 1. L anterior frontal (1) Op 2. R fronto-central (1)	seizure free after Op 2
3	Two seizure types: a. Focal motor to spasms: **R blinking** → bilateral leg thrashing → focal spasms with R arm involvement	a. L temporal rhythm* → spasm complexes# with L temporal emphasis	L insular and perisylvian (4)	a. seizure free
	b. Focal motor: Behavioral arrest → autonomic features → R or L version	b. R hemispheric background attenuation → diffuse LVFA		b. seizure free
4	Focal motor to spasms: Behavioral arrest → L version → **R blinking** with R face jerking → focal spasms of chin	Loss of L temporal IEDs → periodic discharges L centro-parietal & L temporal*	L temporal-parietal-occipital junction (conglomerate of tubers)	seizure free
5	Focal motor: R arm tonic → R version → **R blinking**	L hemisphere background attenuation → L centro-parietal rhythm*	L posterior frontal (conglomerate of tubers)	seizure free
6	Focal motor to spasms: Behavioral arrest → L version and circling → **L blinking** with L face tonic → focal spasms with L shoulder involvement	R temporal rhythm* → diffuse background slowing → bilateral spasm complexes#	Op 1. L posterior temporal (1) Op 2. R temporal-parietal-occipital junction (1)	seizure free after Op 2
7	Focal spasms: Behavioral arrest → spasms with head jerks, L face tonic and **R blinking**	Diffuse background attenuation → spasm complexes# with inconsistent R emphasis	R frontal (1)	>90% reduction in seizure frequency
8	Focal motor to spasms: Behavioral arrest → hypermotor activity → **R blinking** → spasms with variable asymmetries. Few brief tonic seizures.	Diffuse attenuation → R frontal or temporal rhythm* in some seizures → spasm complexes# or diffuse LVFA	R inferior frontal sulcus and circular sulcus (2)	>90% reduction in seizure frequency
9	Three seizure types: a. Focal motor: Bilateral blinking → hypermotor activity +/− → L version	a. Periodic bursts of high voltage spike-wave discharges over left hemisphere	Op 1. L superior temporal (2) and supramarginal gyri (1)	a. seizure free
	b. Focal motor to spasms: Behavioral arrest → L face jerking and **R blinking** → symmetric spasms. Few brief tonic seizures	b. Bilateral spasm complexes*#	Op 2. L occipital (1)	b. seizure free
	c. Focal motor: **R blinking** only	c. No ictal rhythm	Op 3. R frontal (3) and temporal (2)	c. seizures persist
10	Focal motor: Bilateral arms and face stiffening & flushing → **R blinking** with L arm tonic → R version with L face and arm clonic jerking → loss of tone with continued R blinking	R frontal rhythm* → bilateral frontal rhythm → diffuse R hemispheric involvement → generalised discharges	R frontal (2)	seizure free

R = Right; L = Left; LVFA = low voltage fast activity; IEDs = interictal epileptiform discharges; * = ictal rhythm at the time of unilateral blinking; # = bilateral, high voltage, slow wave complexes, sometimes with overriding fast activity, maximal in midline and synchronous with spasms.