

Cortical lesions associated with transient neurological symptoms – not always a matter of cause and effect

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The occurrence of transient recurrent stereotypical neurological events mandates the exclusion of an underlying brain lesion. When imaging studies demonstrate the presence of a structural brain lesion, a cause and effect relationship between the two entities is assumed, and the decision for surgical intervention may then follow almost automatically. We describe five patients with transient neurological events suspected as being seizures that were referred for surgery because of an associated structural brain lesion. Video electroencephalographic recordings revealed that the events that brought these patients to neurosurgical attention were non-epileptic seizures. None of these patients underwent surgical intervention, and all were referred for behavioral therapy. Therefore, even in the presence of a confirmed brain lesion, the presenting paroxysmal events may be of a non-organic origin and should not necessarily be assumed to be caused by the concomitantly existing structural abnormality.

Introduction

Surgical removal of a structural brain lesion is indicated when it is suspected of being malignant or when it is associated with unacceptable neurological dysfunction, such as refractory seizures. The removal of such lesions has been shown to provide significant improvement in the majority of patients with intractable epilepsy (Fried and Cascino, 1997; Kuzniecky *et al.*, 1999).

Assessment of patients referred for epilepsy surgery due to a cortical lesion may disclose discordant information between the electrophysiological findings and the imaging studies. In these cases, additional studies – amongst them invasive recording – may be indicated. The possibility of a structural lesion co-existing with non-epileptic seizures (NES), and the effects on surgical decision-making are only very rarely addressed in the literature (Benbadis *et al.*, 2000; Lowe *et al.*, 2001).

We describe five patients who had been referred for surgical removal of well-defined structural lesions who also had a history of events suspected of being seizures. Video electroencephalographic (EEG) monitoring disclosed NES in all five patients. All were eventually

referred for behavioral therapy, and none of them either required or underwent surgical intervention.

Patients

Patient 1

This 21-year-old woman experienced her first seizure at the age of 19 years. Her family history was remarkable in that her brother suffers from a psychiatric disorder. Her first paroxysmal event consisted of loss of consciousness and convulsions of all four extremities accompanied by confusion lasting for 20 min. These events subsequently recurred daily, always while she was in bed. They began with seemingly impaired consciousness lasting for hours and was followed by tremor of all four limbs which continued for up to 30 min. A brain magnetic resonance imaging (MRI) study showed a cystic lesion in the right temporal region (Fig. 1). Treatment with valproic acid and lamotrigine in therapeutic dosages effected no change in the seizures. The patient was admitted for video EEG monitoring prior to surgical removal of the mass. During this hospitalization, seizures typical of the reported events were recorded, but none was accompanied by epileptiform activity. The patient was diagnosed as having NES and referred for psychological treatment which resulted in improvement of her condition. No similar events were reported in the last 3 years. Because of the presence of the brain lesion, she continued periodic follow-up with serial MRIs.

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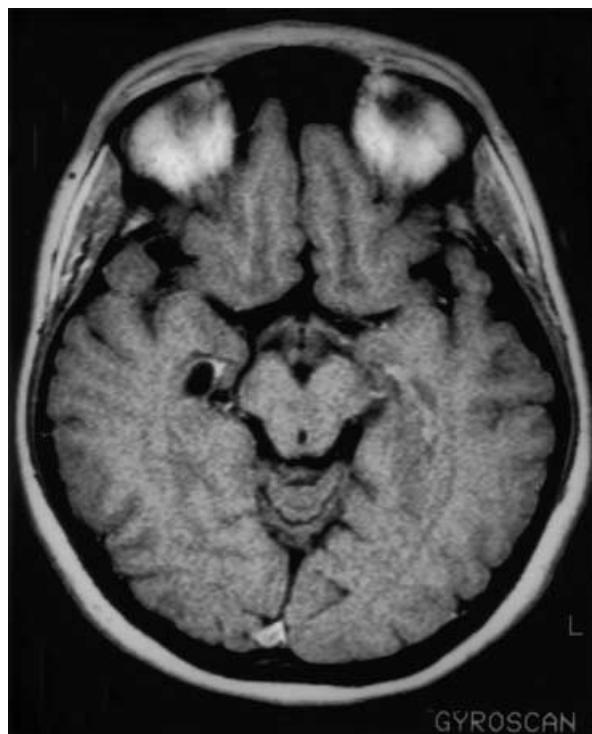


Figure 1 Case 1. Axial T1-weighted post-contrast magnetic resonance image showing a cyst in the right choroid fissure-temporal horn region.

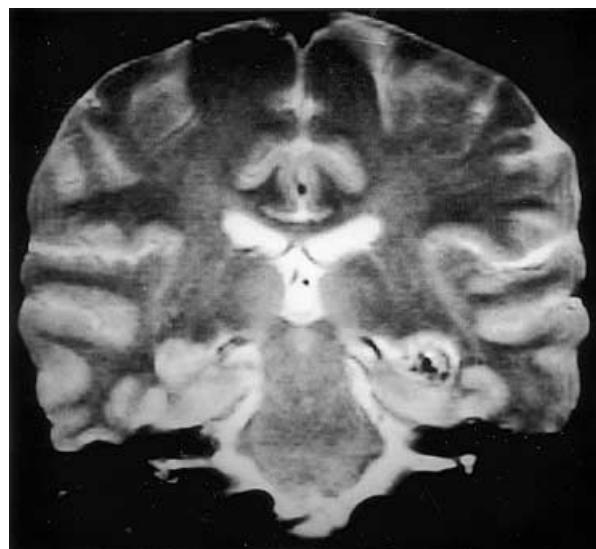


Figure 2 Case 2. Coronal gradient echo T2-weighted magnetic resonance image showing a cavernous angioma involving the left hippocampus.

expectantly with serial MRIs and to reconsider a surgical approach if seizures were shown to be true seizures under anti-epileptic drug (AED) treatment. In the 2 years following, only occasional very short events consistent with complex partial seizures were reported.

Patient 2

This 27-year-old right-handed woman had an unremarkable past and family history. At the age of 17 years, she was involved in a motor vehicle accident and suffered a brain concussion. One year later she began having recurrent episodes of staring, tearing and bilateral movements of the extremities. An interictal EEG showed occasional left temporal sharp waves, and a brain MRI revealed a lesion compatible with a left hippocampal cavernous angioma (Fig. 2). She was treated with lamotrigine, carbamazepine and clobazam without effect. She was referred for surgical resection of the lesion which was ostensibly causing the seizures. Following drug discontinuation, video EEG monitoring demonstrated a single event of unresponsiveness associated with left temporal epileptiform activity. There also were frequent episodes continuing for 10–20 min identical to those witnessed at home by her family, during which the patient cried and moved her extremities in various directions. The latter type was not associated with any detectable EEG abnormality. The patient was offered psychological consultation for NES. The lesion was most probably a cavernous angioma located in the medial temporal lobe on the dominant side. It was, therefore, decided to monitor the patient

Patient 3

This 48-year-old man with an unremarkable past history had been experiencing seizures for 5 years. They began with vertigo and headache and were followed by loss of consciousness and convulsions that lasted for about 30 min. A brain MRI followed by an angiogram showed a right temporal vascular anomaly, compatible with a venous angioma (Fig. 3). The events recurred two to three times a day and were unresponsive to carbamazepine, valproate and clobazam. The interictal EEG was normal. His habitual events were recorded by video EEG monitoring which revealed no epileptiform correlate. The events were diagnosed as being NES, and the patient was referred for psychological treatment. The surgical option was not considered as being indicated, and the patient was lost to follow up.

Patient 4

This 50-year-old right-handed woman had undergone irradiation for tinea capitis in childhood. At the age of 29 years, she underwent surgery for a right parietal meningioma. A post-operative cyst was removed 4 years later. Three years after that, she developed generalized tonic clonic seizures for which she was treated with



Figure 3 Case 3. Digital subtraction angiography revealing a venous angioma. Abnormal vessels are seen to drain the temporal region of the lateral ventricle to the vein of Labbe and deep veins on the right (arrowhead).

carbamazepine, phenytoin and clonazepam. After being seizure-free for 7 years, she experienced events consisting of anxiety, loss of consciousness, side-to-side head movement and tremor of the extremities. A brain MRI revealed multiple meningioma (Fig. 4). The patient was referred for video EEG monitoring in order to identify the lesion responsible for these events. No in-

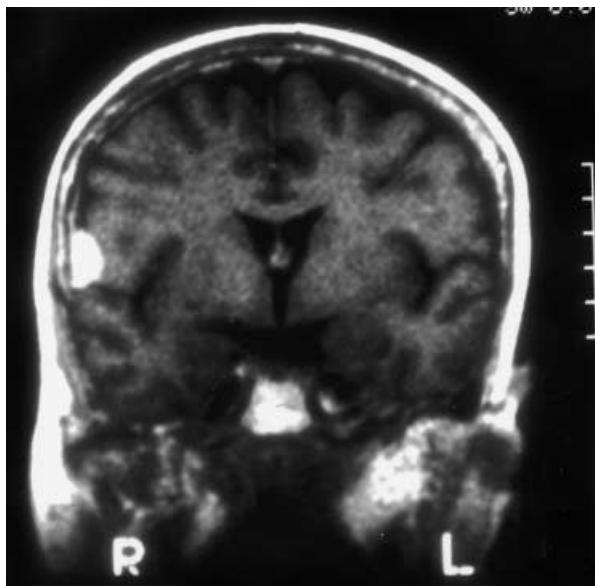


Figure 4 Case 4. Coronal T1-weighted post-contrast magnetic resonance image displaying a convexity meningioma in the right posterior frontal operculum. This was the largest of the multiple meningioma detected in the current study.

terictal epileptiform activity was observed. No events other than those she habitually experienced were recorded and there was no evidence of an epileptiform correlate in the EEG. She was diagnosed as having NES and offered psychological treatment in addition to neuroradiological and neurosurgical follow-up of the lesions. Despite the recommendation, no psychotherapy was undertaken. She continues to have events of 'tremor' which are, however, without any change in consciousness.

Patient 5

This 46-year-old right-handed woman has a brother known to suffer from epilepsy. Her medical history was remarkable for an L4-5 laminectomy with an epidural abscess as a post-operative complication at age 42. Several months after this surgery, she began to complain of persistent headaches. A CT scan and an MRI of the brain demonstrated obstructive hydrocephalus secondary to a tectal tumor. She subsequently underwent insertion of a ventriculo-peritoneal shunt which had to be revised because of shunt infection and malfunction. A successful endoscopic ventriculostomy was eventually performed. After being symptom-free for 3 months, she developed daily episodes of unresponsiveness and non-rhythmic movements of all four limbs which lasted for several minutes. Following each of these events, she complained of headache, fatigue and nausea. An MRI demonstrated shunt tracks in the frontal and parietal lobes with focal parenchymal damage (Fig. 5). Treatment with valproate and clon-



Figure 5 Case 5. Sagittal T1-weighted magnetic resonance image revealing small bony defects (arrows) and parenchymal tracts in the right inferior parietal region as the residua of a previous shunt, and in the frontal region as the residua of endoscopic third ventriculostomy.

azepam produced no salutary effect, and the patient was referred for video EEG monitoring. During hospitalization, no interictal epileptiform activity was observed. Several seizures such as those described above were recorded, with normal EEG activity. The patient was diagnosed as having NES and referred for psychological evaluation and treatment as well as neurosurgical follow-up. Three years later she was no longer under psychiatric observation and although less frequently, continued to report episodes of prolonged unresponsiveness.

Discussion

Structural lesions as incidental findings in brain MRIs may occasionally be evidenced in patients with non-specific complaints such as headache or syncope. If these lesions appear to be benign, they often can be followed rather than be resected. Surgical removal is indicated when the structural brain lesions are symptomatic, e.g. causing intractable seizures. The symptomatology must, however, be shown to be related to the lesion. All of our patients had structural lesions, and were referred for video EEG monitoring prior to surgery. Although none of our patients had risk factors such as previous specific psychiatric history, prior abuse or multiple seizures types, there were some suspicious details in their history such as very prolonged episodes (patients 1–3), tearing during seizures (patient 2), side-to-side head movements (patient 4), and no response to AED treatment. One of the most common phenomenon that causes misdiagnoses in adults is the psychogenic condition. Benbadis *et al.* (2000) described three patients with mesial temporal sclerosis and refractory seizures eventually diagnosed as NES. Lowe *et al.* (2001) had four patients with central nervous system (CNS) lesions in whom appropriate studies showed only psychogenic seizures.

NES are sometimes difficult to diagnose, especially with simple partial seizures which may be associated with false negative EEG findings. However, all of our patients had prolonged events of 'altered consciousness' and strange behavior mimicking complex partial or generalized seizures in which ictal EEG is almost always abnormal. The patients' events represented their habitual episodes as confirmed by family members familiar with these events.

NES are known to coexist with epilepsy. Indeed, these two types were recorded in our second patient. NES (Meierkord *et al.*, 1991; Lies *et al.*, 1992; Amir and Neufeld, 1996; Lesser, 1996) constitute 10–20% or more of the referrals to epilepsy clinics, making it a significant neurologic condition (Benbadis and Hauser, 2000). Patients whose NES are mistaken for epileptic

seizures face a variety of potential iatrogenic hazards. For example, about 75% of patients with NES receive anticonvulsant therapy, which may produce adverse effects (Lies *et al.*, 1992). From 8–10% of these patients have a history of pseudo status epilepticus (Wilner and Bream, 1993). There are reported cases of NES patients who were admitted to an intensive care unit and treated by inducing phenobarbital coma when other antiepileptic medications failed (Taliinsky *et al.*, 2000). Major complications because of emergency interventions for pseudo status epilepticus have included respiratory arrest and septicemia (Pakalnis *et al.*, 1991). The diagnosis of NES is based on the integration of numerous data including careful seizure history, interictal, ictal and video EEG monitoring and electro-clinical correlation by experienced observers (Groppel *et al.*, 2000). The prognosis of NES depends upon correct diagnosis: about 45% of the patients with confirmed NES were reported to be free of seizures after being correctly diagnosed and undergoing appropriate treatment (Meierkord *et al.*, 1991).

Similar to what is reported in the literature, two of our patients became 'seizure free', and in two no significant change was observed.

When contemplating surgery in patients with brain lesions, the decision whether to operate and the nature of the procedure often depends on the presence of seizures. Thus, a low-grade lesion, which might be followed under other circumstances, is more likely to be resected if the patient also suffers from disabling seizures. Such patients may also undergo a more extensive resection, which includes brain tissue in the vicinity of the lesion. Clearly, if the seizures are non-epileptic, both the decision to operate and the extent of the resection may be very different. In addition, the patient's and the surgeon's expectations of seizure control after surgery will obviously depend on the nature of the seizures; NES are, of course unlikely to improve with surgery.

All these factors suggest that pre-operative monitoring of the seizures is prudent. Lesional surgery is based on the assumption that a seizure disorder and the concomitant presence of a cortical lesion are not coincidental. It should be borne in mind, however, that structural brain lesions, whether known or incidental, can coexist with NES. For such cases, the performance of video EEG monitoring is often essential to establish the connection, if any, of these lesions with paroxysmal events in order to avoid unnecessary surgical procedures.

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