Behavioral Manifestations of Frontal Lobe Seizures

Presenter: Silvana Riggio, MD
Institution: The Mount Sinai School of Medicine

INTRODUCTION

Patients with seizure of frontal lobe origin can present with bizarre behavior. At times, this bizarre behavior can be unrecognized or confused with seizure of other origin with nonepileptic events or with psychiatric disorder.

I recently saw a patient who began to experience events that were characterized by terrible fear which was followed by irritability. It was as if she could not stand in place where she was at and felt like running away. She was referred to a psychiatrist who diagnosed her to have panic disorder. She was subsequently treated for panic disorder. Her symptoms did not improve; therefore, she came to see me for a second opinion. Upon asking, the patient reported that the episodes were always the same and that they lasted approximately seconds to minutes. Due to the stereotypicity of the event and a normal routine electroencephalography (EEG), we requested that she would undergo a 24-hour video-monitoring EEG. Stereotypicity can help the physician in the differential diagnosis of psychiatric disorder versus a seizure disorder. During 24-hour video-monitoring EEG, she experienced several of these events. Also, a computer tomography scan was performed, which showed a small meningioma in the orbital frontal region.

It is important that we pay attention to the clinical manifestations, and when necessary order a 24-hour video-monitoring EEG that might help in the diagnosis of seizures of frontal lobe origin. Some of these patients can represent a real challenge for psychiatrists and neurologists. I would like to provide psychiatrists with the strategies to help in the differential diagnosis of seizure of frontal lobe origin.

EPIDEMIOLOGICAL DATA

Ten percent of Americans will have at least one seizure in their lifetime. There are ~150,000 new cases of epilepsy annually, and of those, 70% can be controlled medically and ~20% to 30% are intractable. Several series have reported that between 20% and 50% of patients admitted for monitoring do not have epilepsy. Approximately 20% of the cases I evaluated while running an epilepsy program turned out to have a non epileptic event. I find that very humbling because these are people who were seen by good neurologists in the community and were referred to the epilepsy unit for evaluation of intractable epilepsy and some of them turned out to have nonepileptic seizures.

SEIZURE: *A BRIEF REVIEW*

All seizures can be convulsive or nonconvulsive. Seizures can be partial, primary generalized, or secondary generalized. Partial seizures (or focal seizures) can be simple without impairment of consciousness. Simple partial seizures are at times diffiicult to recognize because they might not have associated EEG changes.

Complex partial seizures have impairment of consciousness at onset. Simple partial seizure can eventually progress to complex partial seizure with or without secondary generalization. Primary generalized seizures initially involves both hemispheres and can be of differenet type: absence, typical or atypical, myoclonic seizure, tonic, clonic, tonic-clonic, and atonic seizure (astatic seizures). Secondary generalized seizures have a focal onset with secondary generalization.

Dr. Riggio is associate professor of psychiatry and neurology at the Mount Sinai School of Medicine in New York City, and director of Consultation Liasion Service at the James J. Peters Veterans Administration Medical Center in Bronx, New York.

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Please direct all correspondence to: Silvana Riggio, MD, 70 East 87th Street, Apt. W20C, New York, NY 10128; E-mail: silvana.riggio@mssm.edu.

Auras

Though it was thought that an aura is a sensation preceding a seizure, an aura is really a simple partial seizure. It is the seizure itself that, at times, can progress to a complex partial seizures and can be associated with confusion, or can be followed by a generalized convulsion. When patients have secondary generalization, then it is easier to make a diagnosis of seizures disorders.

Frontal Lobe Seizures

Seizures of frontal lobe origin are relatively common, but difficult to recognize. Approximately 20% of patients admitted to an epilepsy program will have seizures of frontal lobe origin.[1] Until ~30 years ago, we thought that most seizures were of temporal lobe origin. Not many of us knew about frontal lobe seizure, parietal seizure, or occipital seizure. We talked about temporal lobe seizure because that was what we thought it was all about. But that is not correct. We have now learned a lot more about it.

How do seizures of frontal lobe origin present? They can present with a wide variety of clinical manifestations, and that is why it is difficult to diagnose them. They can mimic other disorders, in particular psychiatric ones, or vice versa. They can pose a real challenge for neurologists and psychiatrists. Factors that limit the study of the frontal lobe include its anatomic size, its extensive networking, and its limited access to the scalp during EEG recording.

The frontal lobe is heavily interconnected with the limbic system. The orbital mesiofrontal region are connected with the cingulate, the hippocampus, and amygdala. Seizures arising in this area may be expressed as complex partial seizures of different origin.[2] Clinical symptoms of frontal lobe origin can, at times, be confused with temporal lobe epilepsy or generalized epilepsy or nonepileptic event or psychiatric disorders.

In the patient mentioned earlier, with episodes of fear, the meningioma was localized in the orbital region; however, the clinical manifestations (fear and irritability) were suggestive of a temporal lobe, amygdala focus because immediately there is a spread through the temporal lobe. She only later had an magnetic resonance imaging (MRI), at which point she was diagnosed to have a meningioma in the orbital frontal region. It was removed, and she is perfectly fine.

To compound this issue, much of the frontal lobe is inaccessible to standard scalp EEG. When you perform an EEG the electrodes are placed on the frontal area, then anterior temporal, and posterior temporal region. If you have a focus on the dorsolateral area, it is easier to pick up paroxysmal discharges; however, discharges from the mesial (interhemisheric) cortex, the orbitofrontal region, and the cingulum often shows no surface EEG correlate during ictal activity as they can be volume conducted over a wide region bifrontally, sometimes with a controlateral maximum. They might spread at a wide angle so that it spreads all over the scalp so that it might not be picked up on the EEG. When it is picked up, it looks like generalized discharges and the fact that they had a frontal lobe discharge can be missed. A large portion of the prefrontal region give us no symptoms on electrical stimulation.

If we have a patient in our office with stereotypic events, that patient is sent to get an EEG. When it comes back normal we believe that the patient did not have a seizure. That is not correct because an initial outpatient standard EEG in detects abnormalities in 29% to 55% of patients. If you perform an ictal EEG, several series have reported no ictal EEG changes in 33% to 36% of patients. Some series have reported that only 14% to 15% of patients with frontal lobe seizures have localized frontal lobe discharges.[2,3]

If a patient has an episode during the EEG it might not be picked it up because if there is a lesion right in the orbital frontal area or mesial area, it can really spread by wide angle and will not be picked it up. Some series have shown that only 40% to 50% of patients with frontal lobe seizures have actually localized frontal lobe discharges.

What are the features that help us in our office to make a decision? Again, stereotypicity. They are always the same because the focus is always in one area of the brain and the spread is normally the same (ie, it does not change from one episode to another). The duration is normally the same (brief), unless it generalizes. Get a detailed history: What is the first thing that comes to your mind? What is it that you remember? Seizures are normally brief and nonspecific, which makes it difficult to diagnose. They can also occur in clusters and they can be nocturnal. Repetitive motor activity is one clue that should direct you toward the diagnosis of frontal lobe epilepsy in patients. Postictal confusion is not a major issue. We asked patients with seizure if they were confused afterward. If they were not confused, we

might think it was not a seizure. However, people with epilepsy of frontal lobe origin have little postictal confusion, if at all.

If a patient has focal motor activity, it might be easier to make a diagnosis of frontal lobe seizure. But seizure of frontal lobe origin can also present with motor automatism, which can be simple or complex. Presentation depends on the area of the frontal lobe involved and whether or not you have a quick spread or not. My patient looked like she had a temporal lobe seizure, which was misdiagnosed to have panic attacks for different reasons. At the end, she had a meningioma in the orbital frontal region.

There are different types of automatism that you can have in frontal lobe seizures, including tapping (eg, people who just go tap their fingers as part of their seizure); kicking; rubbing; pelvic thrusting; thrashing; picking; genital manipulations; scratching; and rearranging on the clothes. There are also behavior manifestations, which can be stereotypic. There can be also speech disturbance, speech arrest, forced vocalization (ie, moaning, grunting); repetition of words; and repetitive motor activity. There can be autonomic dysfunction: dizziness and lightheadedness. Autonomic dysfunction are tough to diagnose. Pseudoabsences and olfactory hallucinations can also be present. Forced thinking is less easy to recognize. Anything that is very strange but is repetitive and occurs over and over again, should make you consider the possibility of a a seizure of frontal lobe origin. There are also can be somatosensory symtpoms, visceral symptoms, hallucinatory or illusional phenomena, and immediate generalization.[4,5]

CASE PRESENTATION #1

The first patient was a 9-year-old female with a 3-year history of focal motor activity of the right arm. She experienced 10–20 episodes/day. The patient had poor response to an anticonvulsant and was brought to the monitoring unit for a surgical evaluation. During evaluation the patient's seizures presented as such: She is sitting down and, when she knows that something is happening, she goes to push the event button. She began screaming at the time that the motor activity started. She had a focal motor seizure of the right arm. The event lasted a few minutes and was not folllowed by a secondary generalization. Her wish was to go ice skating. After surgery, she was seizure free and finally went ice skating.

CASE PRESENTATION #2

A 35-year-old man began to experience episodes during which he reported that he felt scared but did not know why. He felt that "I have to rub my hands, but I do not know why and I cannot stop doing it." The episodes last 1–2 minutes, and they occurred several times daily. He was referred to me by a psychiatrist. The psychiatrist diagnosed him to have obsessive-compulsive disorder (OCD). He was first treated with sertraline, up to 200 mg/day PO QD, with no resolution of his symptoms. Another psychiatrist diagnosed him with panic disorder and switched him to paroxetine, which was titrated up to 60 mg/day. There was still no resolution of his symptoms. Two to 3 months later, he began to experience episodes that were followed by "movement of my legs. I feel I am moving my legs, but I cannot stop it."

We found that his events were always the same. We performed an EEG and an MRI, both of which were normal. I sent him to the video-monitoring unit based on previous experience with patients. Because ~30% of ictal EEG can be normal, the patient was referred to video EEG monitoring. During the video EEG, the patient had a seizure. He did not have OCD and he did not have a panic attack. He had seizures of frontal lobe origin and the episodes were stereotypic. While he was in the the video-monitoring unit and he had these events, some of these which were associated with a normal EEG.

Ictal scalp showed occasionally rhythmical activity of the left frontal region. He was started on an antiepileptic. Due to a poor response, he had intracranial recording because these events were getting in the way of his life. The intracranial recording showed sharp and slow activity over the left mesial orbitofrontal region. There were many times when the EEG was normal, other times he had rhythmical activity. The EEG showed that he had a left mesial orbital frontal region. He underwent intracranial surgery, which improved his symptoms.

CASE PRESENTATION #3

This is a very dramatic case of a 24-year-old right-handed female. At 21 years of age, 2 months after delivering a baby, the patient began to have these episodes of running. She would drop whatever she was doing and run (eg, if she was in a restaurant she would drop the forks and run from here to there) and then come back. Having just had a baby, she would have the baby in her hands, she

would drop her baby, run, and come back. When asked what happened she responded with, "I do not know. I just had to run. I have to run."

Her husband removed all of the furniture from the apartment and they lived with pillows all around. Her husband was traveling so he hired a full-time nurse to care of her. She said, "At times I recall I am having these episodes and.... At times I do not know." These episodes lasted a few seconds to minutes and they occurred ~10 times/day.

The problem was that if she had anything in her hands, she would just go. If she was in a taxi, she would feel like opening the door and get out of the car. Sometimes she knew she was having them but she could not stop them. Sometimes she did not even know she was having them.

Her primary care physician performed a neurological exam, which was normal. She had an EEG during this event. Both ictal and interictal EEG were normal. Her computerized axial tomography scan was normal. A psychiatrist made a diagnosis of dissociative disorder. There was a complicated theory about this woman. The theory was that she did not like her child and was trying to separate from her child, and denied the child. She had a wonderful relationship with her husband who was really understanding of all of this. However, he did not know what to do.

She was followed in psychotherapy for 1 year. Essentially, she was trapped at home with a nurse who followed her all the time and she could not touch her baby. If she had her baby in her arms, the nurse or husband would be right there because during one of her events the risk was that she would just get up from the couch if she had the baby and go. She could not breastfeed her baby. She was treated with sertraline 300 mg PO QD with no resolution of her symptoms.

After a year of having these events, she came to see me at the suggestion of a friend who suffered from a seizure disorder. Her outpatient ictal EEG and non-ictal EEG were normal. However, it was the stereotypicity of these events that had me refer her to the monitoring unit. In the monitoring unit, the interictal EEG were always normal.

The events were stereotypic. Occasionally the ictal EEG showed rhythmical activity over the parasagittal region. The MRI showed a right frontal ganglioglioma. At that point we wondered if this is what is causing this event or not or if they were totally unrelated. As you review this ictal EEGs (we are looking at left side of the brain,and right side of the brain), you see these nice, round 8–10 Hz waves that represent a normal EEG. However, when you look carefully there was a mild rhythmical activity, which can be easily missed. When she had the clinical event, there was an occasional higher amplitudes rhytmical activity, which is the most she would ever have. We still did not know if this was correlated to a lesion, and whether or not removing the lesion was going to help. She was recorded during surgery and we saw that this was an active epileptogenic zone and the epileptogenic zone was extended past the lesion. She had removal of all this area, and she was seizure free. She has not had an episode since and her life has changed. She now works and is able to travel internationally for work.

CASE PRESENTATION #4

A 25-year-old economist who began to experience episodes during which he felt, "I cannot control myself, and I need to ask for water." Episodes occurred suddenly and ended suddenly. He was referred to a psychiatrist who made the diagnosis of poor impulse control. He was started on haloperidol 2 mg PO QD with no symptom improvement. One day, he walked to his boss' office during one of these events, saying, "I need some water! Will you get me a glass?" at which point he was fired.

If you see him in your office doing that, do you really think he has a seizure? No, you think he is strange. To give you a better idea, he was diagnosed with poor impulse control, but the episodes continued at the same rate, despite the haldol. The father was a malpractice lawyer and requested that his son would go for further evaluation, and he scheduled an appointment with me because he had heard of me from one of his clients. Due the stereotypicity of the events, 24-hour video monitoring was conducted. This man was actually having a seizure during these episodes. Ictal EEG showed rhythmical sharp and slow over the right frontal region. MRI was normal. This patient was lucky because this symptom resolved with carbamazepine 600 mg PO QHS.

CASE PRESENTATION #5

A 40-year-old woman presented with episodes characterized by repetitive moaning. Each episode occurred once or twice a week and appeared to be triggered by stress. She had no awareness of these episodes. She had a history of sexual

assault. She would have episodes where she would say, "Ooh! Ooh! Ooh! Ooh!" and then she would stop. She was diagnosed with dissociative disorder for many years until she experienced a secondary generalization convulsion with generalizied tonic-clonic activity right after the moaning. It was not dissociative disorder, it was actually a seizure. She had depth electrodes and a subdural grid in place, and turned out to have severe epilepsy. She did not improve that much even after surgery, just a little bit.

FRONTAL LOBE EPILEPSY

I reviewed 21 patients (12 males; 9 females; 10–60 years of age) with seizure of frontal lobe origin. The repetitive motor activity (ie, rubbing, moaning, running) was present in 62% of patients. That is pretty high because what we again used to think is that seizure of frontal lobe origin presented with focal motor activity, generalized tonic-clonic activity, but we did not think of the rubbing or the moaning as being seizure of frontal lobe origin. Focal motor activity was present in five patients, speech arrest in one patient, and immediate generalization in two patients. Repetitive motor activity was characterized by running, rubbing of the hands, and repetitive moaning or vocalizations. The episodes are pretty brief and the post-ictal phase can be brief. Auras were present in four frontal lobe epilepsy patients and were non-specific. Six patients had bifrontal or generalized spike and slow wave activity; three patients had a strictly frontal focus EEG with a maximum at Fp1, Fp2, F3, and F4, nine patients have focal temporal EEG, and three patients had normal EEG during the event.

Two important factors to keep in mind are normal EEG and interictal EEG do not deny that the patient has a seizure. Always think of stereotypicity, ask patients questions over and over again, and ask them to go over the progression of their events.

CONCLUSION

Seizure of frontal lobe origin may be difficult to diagnosis due to its diverse clinical presentation, the rapid generalization, and scalp recording limitations. Stereotypic bizarre behavior even in the absence of secondary generalized activity should alert physicians to the possibility of seizure of frontal lobe origin. The clinical symptoms of frontal lobe epilepsy can be confusing. A high index of clinical suspicion in combination with electrographic and neuroimaging data can result in improved detection diagnosis and treatment of this common disorder.

Physicians need to pay attention to the clinical presentation, which may help to direct diagnostic evaluation and management. These patients will tell you, if you ask them, when was the first time they had one of these events. "What do you remember? Tell me the first thing that you remember, and what happens after that?" And they will tell you in detail. That is the way that you can help yourself make the diagnosis and you can help them. They will tell you, it is always the same. If the focus is always in one area of the brain, the symptoms will be the same. The clinical symptoms can be confusing, and high index of suspicion in combination with electrographic or neuroimaging data can result in improved detection, diagnosis, and treatment of this common disorder. ***CNS***

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