

Disney to Pixar Transition Causing Epilepsy: A Case Report of Reflex Epilepsy

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Abstract

This case report describes a rare instance of reflex seizures in a 4-year-old boy with a complex medical history, including total anomalous pulmonary venous connection and developmental disabilities. The patient experienced seizures triggered exclusively by a specific visual stimulus: the transition scene from the Disney castle to the Pixar lamp in Disney-Pixar movies. Video electroencephalography (EEG) revealed biphasic rhythmic delta waves and diffuse slowing, suggesting parietal involvement and complex cortical processing. The findings highlight the individualized nature of reflex epilepsy and highlight the need for a nuanced understanding of specific seizure triggers. Effective management included avoiding the identified visual stimulus and adjusting medication based on the patient's response. This case emphasizes the intricate relationship between sensory processing and epileptogenic mechanisms, contributing to our knowledge of cortical excitability and guiding targeted treatment strategies for reflex seizures.

Keywords

Disney, Pixar, reflex epilepsy, seizure, visual

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Reflex seizures are epileptic events triggered consistently by specific stimuli, cognitive or sensory, that can elicit a generalized or focal seizure. Triggers have a wide range from flashing lights to activities like reading or playing.¹⁻⁶ The prevalence of reflex epilepsy can depend on the region; a study done out of Istanbul found a rate of 6.5%, whereas a rate of 8.9% was seen in a Sri Lankan population.⁷ Although many stories in early years suggest the idea of reflex seizures, it was only formally classified by the International League Against Epilepsy (ILAE) in 1989.² Stimuli evoking a seizure can be intrinsic, extrinsic, or both. Extrinsic stimuli can be simple, such as flashes of light or reading. Intrinsic stimuli can range from elementary movements to higher brain functions such as certain emotions, calculations, or decision making.

Extrinsic reflex epilepsy, such as photosensitivity, is by far the most common form of reflex seizures, with a prevalence of 2% of all patients with new diagnosis of epilepsy, but it increases to 10% when restricted to the age range 7-19 years.⁸

In this case report, we detail a 4-year-old patient that has approximately 50% of his seizures brought on by the visual stimulus of the transition of the Disney castle to Pixar logo at the beginning of every Disney-Pixar movie.

Case History

The patient is a 4-year-old boy with a significant medical history of total anomalous pulmonary venous connection (TAPVC) status post repair, congenital hypothyroidism, gastroesophageal reflux disease, and is nonverbal with suspected autism. The

patient was born at 39 weeks and, after delivery, was cyanotic, requiring intubation. He was found to have obstructed supracardiac total anomalous pulmonary venous connection, which was repaired at day 1 of life. He spent 4 weeks in the neonatal intensive care unit and required extracorporeal membrane oxygenation and cardiac resynchronization therapy for multiple organ failure and had cardiopulmonary arrest. He also had a positive newborn screen for hypothyroidism consistent with laboratory findings of increased thyroid-stimulating hormone at day 3 of life. He started levothyroxine and has continued since then.

He initially presented to the emergency department with unusual episodes of body jerking, and altered level of mental awareness, with arm clenching and facial grimacing. He was noted to always turn to the left. The episodes have slowly become more frequent over the past several months and increase when the patient is fatigued. His mother noticed that the episodes can be provoked by playing the opening scene of Disney-Pixar movies. Specifically, the patient has an episode every time a movie has the transition scene from the Disney castle with fireworks to the Pixar lamp scene. This is only induced by visualizing the transition scene. The sound associated with it does not trigger the episode.

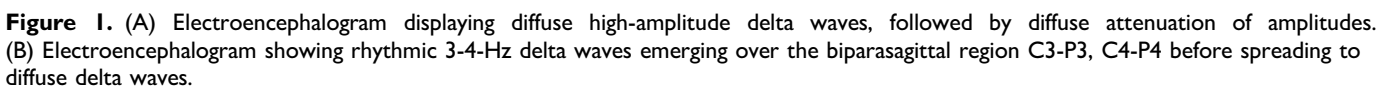
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diffuse high-amplitude delta waves, followed by diffuse attenuation of amplitudes (Figure 1A). Rhythmic 3-4-Hz delta waves emerged over the biparasagittal region C3-P3, C4-P4

before spreading to diffuse delta waves (Figure 1B). The diffuse delta slowing waxed and waned in frequency and amplitude (Figure 2A) before resolution (Figure 2B). Clinically, the

patient suddenly jerked and displayed tonic flexion of the arms with facial grimace. His head turned slightly to the left. He hyperventilated as the diffuse slow waves emerged on

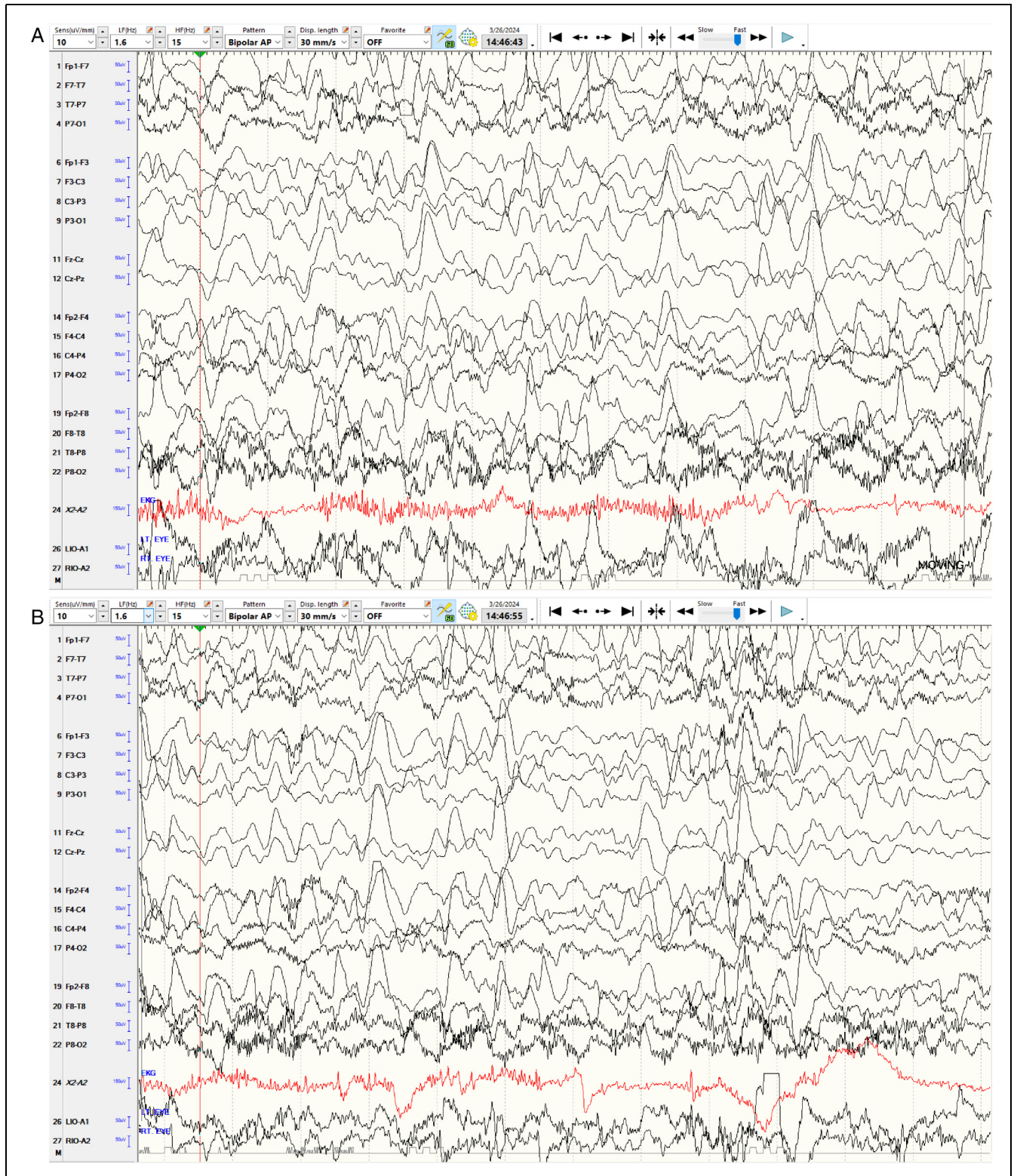


Figure 2. (A) Electroencephalogram shows the diffuse delta slowing with waxing and waning in frequency and amplitude. (B) Electroencephalogram before resolution.

EEG, and appeared uncomfortable and disoriented as he kicked his legs up and down. The seizures were provoked by playing the opening theme of Disney-Pixar movies.

The diagnosis of focal epilepsy with reflex seizures was made. This is an extrinsic reflexive epilepsy because the seizures are provoked by the transition from Disney to Pixar. There were no other provoking factors, although he could have occasional unprovoked seizures. A magnetic resonance imaging (MRI) was previously obtained at 2 weeks of age and 1 month of age to monitor for any sequelae of his extracorporeal membrane oxygenation. Findings included small supratentorial and infratentorial subdural hemorrhages, and minimal left perilateral ventricular leukomalacia, which both displayed expected organizational changes at the 2-week MRI, and mild prominence of the lateral and third ventricles mildly improved at the 1-month MRI. An MRI was ordered after his diagnosis of epilepsy, however the family has not yet been able to obtain the study.

The patient was started on levetiracetam and parents were counseled on epilepsy and instructed to avoid the transition part of the Disney-Pixar movies. At 1 month, parents reported increased aggression and irritability; hence, the patient was tapered off of levetiracetam and started on oxcarbazepine. At his 3-month follow-up appointment, the parents reported seizure freedom on oxcarbazepine without any adverse effects. He is now able to watch the transition without having a seizure. The epilepsy team discussed with the family that if seizures return, then it would be appropriate to pursue further investigation and identify the epileptogenic region for consideration of surgical intervention via resection, ablation, or neuromodulation.

Discussion

Reflex seizures represent uncommon epileptic occurrences consistently provoked by specific stimuli, whether visual, auditory, or tactile. The pathophysiology of these seizures can vary, influenced by a range of inciting factors.⁹ This can include genetic predisposition, structural brain abnormalities, alterations in neurotransmitter systems, or any combination of the three. Visual-induced reflex seizures, for instance, can entail abnormal neuronal excitation triggered by specific visual stimuli like flashing lights or patterns.^{10,11} Some patients can also be sensitive to cognitive or action activation, triggering seizures, such as having certain thoughts. The underlying pathophysiology often entails excitations of the cortical processing and hyperexcitability within visual processing regions of the brain, notably the occipital lobe. Nonspecific factors such as sleep deprivation and drug use can also play a role in reflex seizures.

However, instances where seizures are precipitated by highly specific visual stimuli, such as a particular Disney-Pixar transition scene, suggests a potentially elevated level of cortical functioning.¹⁰ This heightened cortical processing may signify intricate neural networks and cognitive processes, potentially localized to regions associated with visuospatial perception and attention, such as the parietal lobe. Hence, the manifestation of reflex seizures triggered by a particular movie scene may

highlight a distinctive interaction among sensory processing, cognitive function, and epileptogenic mechanisms, accentuating the intricate nature of cortical excitability in reflex epilepsy.

EEG findings in reflex seizures can provide further insights into the underlying pathophysiology. In this case, we saw biphasic rhythmic delta waves before diffuse spread, which could suggest the involvement of the parietal region in the epileptogenic network as mentioned earlier.

Location-specific reflex epilepsy is distinctive and can have great implications in treatment. When seizures are triggered by stimuli specific to particular brain regions, this could suggest brain abnormalities. This suggests that the pathophysiology of reflex seizures may involve localized abnormalities or dysfunctions within specific cortical areas or neural networks.¹² Understanding the precise pathophysiological mechanisms underlying location-specific reflex epilepsy is crucial for developing targeted therapeutic approaches aimed at modulating neuronal excitability and preventing seizure generation in affected individuals.

Conclusion

This case report highlights a rare instance of reflex seizures triggered by a specific visual stimulus—the transition scene in Disney-Pixar movies—in a 4-year-old with a complex medical background and developmental delays. This case highlights the need for a nuanced understanding of reflex seizures and their triggers, guiding effective management strategies and targeted interventions. It also emphasizes the intricate interplay between sensory processing, cognitive function, and epileptogenic mechanisms, advancing our understanding of cortical excitability and enhancing treatment approaches for these challenging conditions.

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Declaration of Conflicting Interests

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