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Unlocking the Brain's Symphony: A Case Study on How Anti-Epileptic Medication and Environment Affects One's Behaviour

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ABSTRACT

Epilepsy, one of the most prevalent neurological disorders worldwide, is marked by recurrent seizures caused by sudden, irregular electrical activity in the brain. Anti-epileptic drugs (AEDs) remain the cornerstone of seizure management, but their use can result in significant cognitive and behavioral side effects, impacting patients' quality of life. This study explores a case of a 63-year-old female patient with epilepsy, focusing on the behavioral side effects associated with her AED regimen, which includes Epiliv 250, Lobazam, and Zeptol 200. Observed effects include aggression, irritability, and emotional lability, exacerbated by stressors such as medical visits. While AEDs effectively reduce seizure frequency, side effects related to mood, behavior, and cognition are common, often requiring dose adjustments and psychosocial interventions. This paper discusses the mechanisms behind these behavioral changes, from neurotransmitter modulation to neuroplasticity alterations, and emphasizes the importance of personalized treatment plans, routine monitoring, and family education. Addressing the broader behavioral impact of AEDs is crucial for optimizing therapeutic outcomes, as individualized care can help maintain patients' overall quality of life while achieving seizure control.

Keywords: behavioral changes, anti-epileptic drugs, epilepsy, seizures

INTRODUCTION

Epilepsy is the fourth most common neurological condition in the world.[3] Epilepsy is a long-term brain condition that causes recurrent, unprovoked seizures. A sudden uncontrolled electrical activity within brain cells causes seizures.[2] Seizures can include changes to your awareness, muscle control, sensations, emotions and behavior. Hence, Epilepsy is also called a seizure disorder.

The neurons in the brain receives impulses from all parts of the body, these electrical impulses travel in a very rhythmic manner from one cell to another. Epilepsy disrupts this rhythmic transmission, instead there is a sudden surge of electrical energy. Epilepsies are classified according to the type of seizures, there are mainly two types: Focal onset seizures and Generalized seizures; Focal onset seizures are further divided into Focal onset aware seizure (person is awake during the episode) and Focal onset impaired awareness seizure (maybe unaware, confused or lost consciousness during the episode). Generalized seizures are divided into Absence seizure (causes a blank stare with a short loss of awareness), Atonic seizure (loss of muscle control), Tonic seizure (whole body maybe tense or still),

Clonic seizure (continuous fast jerks), Tonic-clonic seizure (combination of muscle stiffness and jerking) and Myoclonic seizure (shock like muscle jerk or twitching).

In most cases the cause of seizures is unknown; some of the known causes are genetics, mesial temporal sclerosis, head injury, brain infections, immune disorders, developmental disorders, metabolic disorders and brain conditions and abnormal blood vessels.[2]

Test like electroencephalogram (EEG) and brain scans (like MRI) can help in diagnosing the condition.

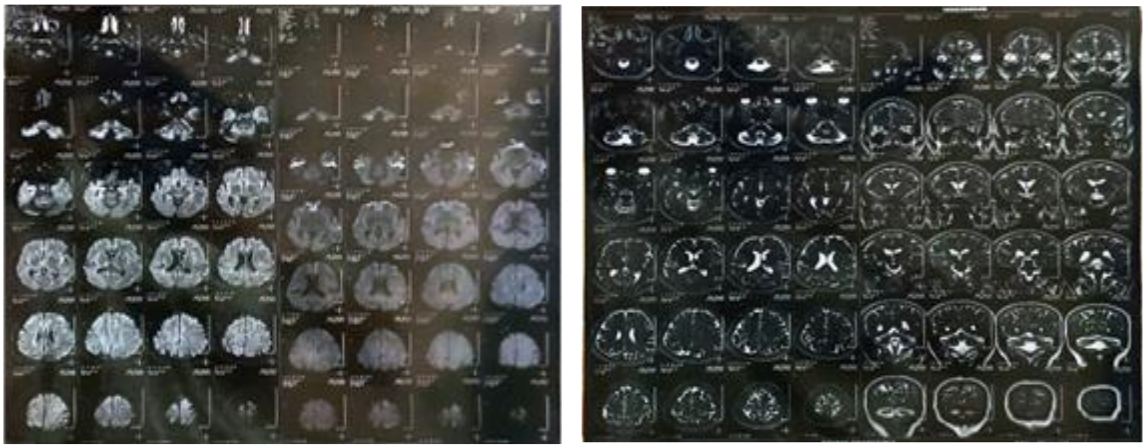
Treatments to control epilepsy include anti-seizure medications, special diets (ketogenic diets) and surgery. Unfortunately, there is no cure for epilepsy; About 70% of people become seizure-free with proper treatment within a few years. The remaining 30% are considered to have drug-resistant epilepsy.

Emotions and moods are very closely related to the limbic area of the brain, and this area is more frequently involved in seizures and seizure like activities. A sudden surge in these areas of the brain gives rise to different behavioural changes.

This paper focuses on highlighting the behavioural changes caused by specific epileptic medications. In this case, the patient is on regular monitoring and long-term treatment with medications. Through this study, the paper seeks to draw attention to the specific side effects of anti-epileptic medications and how the society can be understanding and supportive in their journey.

CASE PRESENTATION

This case is of a 63-year-old female, present to the ER with deep laceration of 3 X 2 X 2.5 cm on the right eyebrow. The patient on visit is afebrile, with a blood pressure of 110/80 and a pulse of 79. She is a long-term epileptic patient. The patient is currently on a regimen of anti-seizure medications, including: Epiliv 250, Lobazam and Zeptol 200 (regular follow-up and monitoring of medication efficacy and side effects). The patient is alert, reflexes are symmetrical. The patient has mild motor deficits due to frequent falls caused by muscle weakness and frequent episodes in the past. The family members of the patient express concern about behavioural changes like aggression and also triggers like stress. She gets an episode of seizure when informed about a doctor's appointment, small surgery or even a diagnostic test like MRI. Family members suspect the injury was caused by an episode due to stress about an upcoming doctor's appointment and MRI. A non-contrast brain MRI (Fig.1) was advised; the cerebral white and gray matter shows normal configurational patterns and signal intensities in T1 and T2 weighted scans. Bilateral basal ganglia. No acute infarcts seen. No focal neuroparenchymal abnormalities seen. No acute infarcts/ bleeds.



(Fig.1)

PATIENT HISTORY

The patient was diagnosed with epilepsy at the age of 3 following a febrile seizure. Over the years, the patient experienced various types of seizures, predominantly tonic-clonic seizures. Seizures frequency has varied throughout life, with period of increased activity during stressful situations. The patient was not provided with accurate treatment due to non-advancement of treatment options in her childhood. Appropriate treatment was received by the patient at the age of 23 with medications (Epiliv 250, Lobazam and Zeptol 200) along with regular follow-ups. Management was based on medication adherence and lifestyle adjustments to minimize episodes of seizures. Since then her seizures are under control. Given the patient's age and delay in treatment, consideration of cognitive effect and medication side effects are critical.

Treatment plan was consolidated with regular follow-up and medication.

Over the years, family members noticed mild to moderate behavioural changes, the patient shows signs of aggression and irritability to small talks and advices; she gets emotional during hospital visits and overly self-conscious. The patient also gets an episode of seizure during stressful situations. These symptoms tend to reduce with lowering the dose of medication.

TREATMENT

Considering the current case, the following medications were used and these are the side effects:

Epilive 250mg- Irritability, aggression, Decreased ability to cope with daily life, Depression, Excessive emotional reactions or frequent mood swings or changes, Severe anxiety, agitation, or confused thoughts, Thoughts of suicide.

Lobazam - Lobazam 5 MG Tablet is a benzodiazepine medicine used to control seizures in adults and children above 2 years of age. It is recommended to start with a small dosage and increase gradually. Do not stop abruptly taking this medicine as it may cause withdrawal symptoms like convulsions, behavioral disorders, tremors, and anxiety.[4]

Zeptol 200mg- Zeptol 200 MG Tablet is a medicine that contains Carbamazepine. It is used in the treatment of certain types of seizures (a sudden, uncontrolled electrical disturbance in the brain causing abnormal behaviour and loss of consciousness) and trigeminal neuralgia (a nerve disorder that affects the face causing sudden and severe pain). Zeptol 200 MG Tablet works by decreasing the abnormal electrical activity in the brain. Zeptol 200 MG Tablet may also cause mood and behavioural changes. If you experience mood changes or suicidal thoughts, contact your doctor immediately.[5]

DISCUSSION

The main goal of anti-epileptic drugs (AED's) is to reduce the incidence of seizures with minimal side effects.

All anti-epileptic drugs have a certain effect on mood and behavior in epileptic patients, these psychotropic effects can be negative and positive depending on the patients medical history, life style and biological and psychological predisposition.[1] Often these behavioural side effects (BSE's) are not evidently noticed as these behavioural changes are overlooked and ignored referring these changes to hormonal or age-related misbehavior.

Usually side effects starts to show due to excessive concentration of drug in the blood; therefore, symptoms like depression, anger, irritability and other signs of behavioral changes seen.[3] According to a study conducted by the Columbia and Yale database project, that reviewed the effects of different medications on epileptic patients showed 17.2% of patients struggling with psychiatric and behavioural side effects, of which Levetiracetam has the highest PBSE (22.1%), On the other hand, carbamazepine (CBZ), clobazam (CLB), gabapentin (GBP), lamotrigine (LTG), oxcarbazepine (OXC), phenytoin (PHT), and valproate (VPA) were significantly associated with a decreased PBSE rates. [6]

The primary objective of anti-epileptic drugs (AED's) is to diminish the frequency of seizures with minimal side effects.

According to the WHO, 70% of epileptic seizures worsen due to improper treatment. Antiepileptic treatments—a class of drugs that work by either altering the electrical activity of neurons via sodium-potassium pumps or by inhibiting the uptake and release of certain neurotransmitters—are essential for management. These drugs are classified based on their site of action.

The mechanism of action of anti-epileptic drugs (AED's) can significantly affect one's behaviour through several pathways:

GABA ENHANCEMENT: Medications like Benzodiazepines and Phenobarbital enhances the action of gamma-aminobutyric acid (GABA), this is the main inhibitory neurotransmitter in the brain. While increased GABA activity often results in anxiolytic (anxiety-reducing) effects and sedation, it can also lead to excessive sedation, cognitive slowing, and impaired motor function. This is particularly problematic in tasks requiring alertness or coordination.

Sodium Channel Blockers: Drugs that act as Na+ channel blockers include carbamazepine, ethotoin, phenytoin, primidone, lacosamide, lamotrigine, oxcarbazepine, rufinamide, topiramate, zonisamide, valproic acid, and felbamate.[3] Since a number of these drugs are associated with BSEs, it is likely that Na+ transport and homeostasis influence mood and behavior, and some evidence for this exists. Studies indicate that patients with affective disorders exhibit high plasma Na+ levels and that low Na+ diets have positive effects on mood.[8]

Then, there are drugs that prevent calcium influx, which is responsible for the release of excitatory neurotransmitter (glutamate) vesicles. These include lamotrigine and topiramate, which are high voltage-activated calcium channel blockers. Pregabalin and gabapentin are other drugs known to act on high-voltage-activated calcium channels, but they do so via the alpha-2-delta-1 subunit, which modulates the release of excitatory neurotransmitters from the presynaptic neuron. Valproic acid and zonisamide are T-type or low-voltage-activated calcium channel blockers present on the postsynaptic neuron. Another class of drugs acts on the SV2A protein on vesicles, impairing the release of glutamate into the synaptic cleft; this includes the drug levetiracetam. Felbamate is a drug that blocks the NMDA calcium receptor, thus preventing neuronal excitation. Modulating these channels helps prevent seizures but can also lead to changes in mood and cognition, such as irritability or anxiety. Voltage-gated Ca2+ channels are another target for AEDs. Ethosuximide, valproic acid, lamotrigine, and zonisamide inhibit low voltage–activated T-type Ca2+ channels, which are implicated in absence seizures. genetic variations in an L-type voltage-gated Ca2+ channel are associated with increased risk of bipolar disorder, depression, and schizophrenia.[8]

Glutamate inhibitors: Some drugs like Topiramate, reduces the excitatory activity of glutamate. It prevents overstimulation, in turn results in more stable emotional state. By stabilizing neuronal activity, these medications can help improve mood and reduce irritability in some patients. However, excessive inhibition might lead to feelings of lethargy or decreased motivation.

Long-term Changes, Chronic AED use may influence neuroplasticity, affecting synaptic strength and neural circuitry, which could alter emotional regulation and cognitive functions over time; Changes in neuroplasticity can contribute to mood disorders or cognitive impairment, affecting overall behavior. Anti-epileptic drugs (AEDs) can lead to a range of cognitive and behavioral effects. Common cognitive impairments include difficulties with attention, memory (particularly short-term recall), and processing speed, with older AEDs like phenobarbital generally causing more pronounced deficits than newer agents like lamotrigine and levetiracetam. Mood alterations are also significant; certain AEDs, such as valproate, may increase depressive

symptoms, especially in individuals with a history of mood disorders, while some patients experience heightened anxiety with drugs affecting
excitatory neurotransmission. Conversely, medications like lamotrigine can stabilize mood, particularly in bipolar disorder. Behavioral changes may manifest as increased irritability and aggression, notably with levetiracetam, particularly in children and adolescents, as well as
emotional lability, characterized by mood fluctuations and sudden outbursts. Additionally, many AEDs induce sedation, fatigue, and lethargy, especially carbamazepine and gabapentin, which can disrupt daily activities, reduce motivation, and ultimately diminish quality of life.
ndividual variability in response to anti-epileptic drugs (AEDs) is influenced by several factors, including genetic, comorbid conditions, age, and gender. Genetic polymorphisms, particularly variations in cytochrome P450 enzymes, can significantly affect drug metabolism and responsiveness, impacting both seizure control and behavioral side effects. Individuals with co-occurring psychiatric conditions, such as anxiety or depression, may experience exacerbated symptoms with certain AEDs, complicating treatment and behavioral outcomes. Age plays a crucial role as well, with children being more susceptible to cognitive and behavioral side effects due to their developing brains, while older adults may face heightened sensitivity to sedation and cognitive impairment. Additionally, hormonal fluctuations in women can affect how AEDs influence mood and behavior, especially during menstrual cycles, pregnancy, or menopause, further contributing to variability in treatment responses.
Monitoring and management of anti-epileptic drugs (AEDs) require a comprehensive approach that includes regular assessment of seizure control and behavioral side effects. Healthcare providers often utilize standardized questionnaires and scales to evaluate mood and cognitive function continuously. Adjusting dosages or switching to different AEDs is vital to mitigate negative behavioral effects, aiming to find the optimal balance between effective seizure management and tolerability. In addition, psychosocial interventions, such as cognitive-behavioral therapy, can be effective in addressing mood disorders and anxiety, especially when combined with medication. Psychoeducation for patients and families about potential side effects is essential for recognizing and managing behavioral changes. Furthermore, promoting a healthy lifestyle through regular physical activity, balanced nutrition, and good sleep hygiene can support overall mental health and help alleviate some behavioral effects associated with AED use.

CONCLUSION

In conclusion, anti-epileptic drugs (AEDs) play a critical role in seizure management, yet they often bring about notable changes in mood, behavior, and cognition. These effects are influenced by a range of factors, including genetics, age, comorbid conditions, and even hormonal fluctuations, highlighting the need for individualized treatment approaches. Effective management of AEDs goes beyond seizure control; it involves proactive monitoring of behavioral and cognitive changes, timely dose adjustments, and integrating psychosocial support. Educating both patients and their families about potential side effects, alongside adopting healthy lifestyle practices, is essential in addressing the broader impact of AEDs. With a holistic approach, healthcare providers can help patients achieve the delicate balance between effective seizure control and maintaining a high quality of life, ensuring that AED treatment remains both safe and effective over the long term.

Declaration by Authors

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REFERENCES

1. Gilliam F, Hecimovic H, Sheline Y. Psychiatric comorbidity, health, and function in epilepsy. Epilepsy Behav. 2003;4 Suppl 4: S26-S30. doi: 10.1016/j.yebeh.2003.09.009.
2. Epilepsy. Cleveland Clinic. Accessed November 7, 2024. https://my.clevelandclinic.org/health/diseases/17636-epilepsy.
3. What is Epilepsy? Epilepsy Foundation. Accessed November 7, 2024. https://www.epilepsy.com/what-is-epilepsy.
4. Lobazam 5 MG Tablet. Practo. Accessed November 7, 2024. https://www.practo.com/medicine-info/lobazam-5-mg-tablet-31324.
5. Zeptol 200 MG Tablet. Practo. Accessed November 7, 2024. https://www.practo.com/medicine-info/zeptol-200-mg-tablet-16803#:~:text=Zeptol 200 MG Tablet should be used with caution due, develop thoughts of self-harm
6. Belcastro V, Striano P. Antiepileptic drugs and suicide risk: a review of current evidence. Curr Neurol Neurosci Rep. 2017;17(9):72. doi:10.1007/s11910-017-0778-6.
7. Alper K, Schwartz KA, Kolts RL, Khan A. Seizure incidence in psychopharmacological clinical trials: an analysis of Food and Drug Administration (FDA) summary basis of approval reports. Biol Psychiatry. 2007;62(4):345-354. doi: 10.1016/j.biopsych.2006.09.008.
8. Kerr MP, Mensah S. Behavioral side effects of antiepileptic drugs. US Pharm. 2018;43(8):32-36.

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