CLINICAL ANALYSIS OF THE EFFICACY AND ADVERSE EFFECTS OF ANTICONVULSANT THERAPY IN EPILEPSY

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Abstract: *Epilepsy is a chronic neurological disorder characterized by recurrent seizures, significantly impacting patients' quality of life. Anticonvulsants, including valproate, carbamazepine, lamotrigine, and levetiracetam, are commonly prescribed to manage seizures. This study systematically evaluates the clinical efficacy and adverse effects of these drugs, using data from recent clinical trials and meta-analyses. Findings indicate that levetiracetam and valproate exhibit the highest efficacy, with predominantly mild to moderate adverse effects. Combination therapy demonstrates improved outcomes in refractory cases. Individualized therapy and regular monitoring are essential to optimize treatment outcomes. These results provide evidence-based guidance for effective epilepsy management.*

Keywords*: Epilepsy; Anticonvulsant therapy; Efficacy; Adverse effects; Individualized treatment.*

Introduction

Epilepsy is a widespread neurological disorder affecting more than 1% of the global population, with higher prevalence in low- and middle-income

countries [1,2]. It is characterized by recurrent, unprovoked seizures resulting from abnormal electrical activity in the brain, which can significantly compromise social, psychological, and medical aspects of patients' lives [3,4]. Epilepsy is associated with increased risk of cognitive impairment, psychiatric comorbidities such as depression and anxiety, and reduced quality of life [5,6]. Anticonvulsants, also known as antiepileptic drugs (AEDs), constitute the mainstay of epilepsy treatment. These medications aim to control seizures, prevent recurrence, and reduce complications related to prolonged or uncontrolled seizures [7,8]. Commonly used AEDs include valproate, carbamazepine, lamotrigine, and levetiracetam, all of which have been extensively evaluated for their efficacy and safety profiles [9,10]. The choice of AED depends on multiple factors, including seizure type, patient age, comorbid conditions, potential drug interactions, and the side-effect profile [11,12]. Despite their efficacy, AEDs may cause adverse effects such as dizziness, somnolence, liver dysfunction, hematological changes, weight gain, and hypersensitivity reactions, which can limit patient adherence [13,14]. Recent studies emphasize the importance of individualized therapy, considering pharmacogenetic factors, lifestyle, and long-term monitoring to optimize therapeutic outcomes and minimize adverse events [15,16]. Moreover, combination therapy is often required in refractory epilepsy cases, where monotherapy fails to achieve adequate seizure control [17,18]. This study aims to systematically assess the efficacy and safety of commonly used anticonvulsants, compare their clinical outcomes, and provide evidence-based recommendations for individualized epilepsy management.

Materials and Methods

A systematic literature review was conducted using PubMed and Scopus databases, focusing on studies published between 2020 and 2026. Inclusion criteria were as follows:

*Clinical studies evaluating the efficacy and safety of AEDs.

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*Randomized controlled trials and meta-analyses

*Studies including both pediatric and adult populations.

*Studies reporting statistical outcomes such as seizure frequency, treatment response rates, dosage, and adverse effects.
Key variables analyzed included seizure control percentages, treatment response rates, and prevalence of adverse effects. Data were presented using tables and diagrams to enhance clarity.

Inclusion and Exclusion Criteria

Inclusion criteria were as follows:

- Clinical studies assessing the efficacy and safety of AEDs in both pediatric and adult populations [5,6].
- Randomized controlled trials (RCTs), observational studies, and meta-analyses [7].
- Studies reporting quantitative outcomes such as seizure frequency, treatment response rates, drug dosages, and prevalence of adverse effects [8].

Exclusion criteria included:

Animal or in vitro studies [9].

Case reports, conference abstracts, and studies lacking statistical outcome data [10].

Studies not published in English [11].

Data Extraction and Analysis

Two independent reviewers extracted relevant data, including:

Patient demographics (age, sex, comorbidities) [12].

Type and duration of epilepsy [13].

AED type, dosage, and treatment duration [14].

Clinical efficacy measures (percentage of seizure control, treatment response rates) [15].

Adverse effect profiles, including frequency and severity [16].

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Discrepancies between reviewers were resolved through consensus or consultation with a third reviewer [17]. Data were summarized using tables and diagrams to enhance clarity. Statistical outcomes from included studies were synthesized qualitatively, and meta-analytic data were incorporated when available [18].

Ethical Considerations

As this study involved a review of published literature, no direct patient contact or ethical approval was required. However, all included studies adhered to ethical standards and obtained relevant institutional approvals [19].

Results

Efficacy and Safety of Anticonvulsants

	Drug	Seizure control	Common adverse effects	Agr range (years)
1	Levetiracetam	72–85	Dizziness, somnolence	6–60
2	Valproate	68–80	Elevated liver enzymes, weight gain	3–55
3	Lamotrigine	65–78	Skin allergies, headache	2–50
4	Carbamazepine	60–75	Hematologic changes, somnolence	5-55

❖ Individualized drug selection and optimized dosing were associated with higher treatment efficacy [1].

❖ Most adverse effects were mild or moderate; only 5–10% of patients discontinued therapy due to side effects [6].

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❖ Combination therapy, particularly valproate with levetiracetam, was more effective in refractory epilepsy [7].

Discussion

This review highlights the efficacy and safety of commonly used antiepileptic drugs (AEDs) in both pediatric and adult populations. Among the evaluated drugs, levetiracetam and valproate consistently demonstrated the highest seizure control rates, ranging from 72–85% and 68–80%, respectively [1,2].

These findings are consistent with previous systematic reviews and meta-analyses, confirming their effectiveness as first-line treatments for focal and generalized seizures [3,4].

Lamotrigine and carbamazepine showed slightly lower efficacy, with seizure control ranging from 65–78% and 60–75%, respectively, but remain valuable options depending on seizure type, patient comorbidities, and tolerability [5,6].

Lamotrigine, in particular, is preferred in patients at risk of weight gain or liver dysfunction due to its favorable safety profile [7].

Adverse effects were generally mild to moderate, including dizziness, somnolence, liver enzyme elevation, weight gain, hematologic changes, and skin reactions [8,9].

Only a small proportion of patients (5–10%) discontinued therapy due to adverse events, highlighting that with appropriate monitoring and dose adjustments, AEDs are well tolerated [10].

Individualized therapy, considering factors such as age, comorbidities, pharmacogenetics, seizure type, and lifestyle, is crucial to optimizing treatment outcomes [11,12].

Recent studies emphasize that pharmacogenetic testing may help predict adverse reactions and improve drug selection, especially for valproate and carbamazepine [13,14].

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Combination therapy is increasingly employed in refractory epilepsy, where monotherapy fails to achieve adequate seizure control. Studies indicate that combinations such as valproate plus levetiracetam significantly improve seizure outcomes while maintaining an acceptable safety profile [15,16].

However, careful monitoring is necessary to detect potential drug interactions and cumulative adverse effects [17].

Conclusion

Anticonvulsant therapy remains the cornerstone of epilepsy management, demonstrating both efficacy and safety across pediatric and adult populations. Among commonly used antiepileptic drugs (AEDs), levetiracetam and valproate showed the highest seizure control rates and were generally well tolerated, with predominantly mild or moderate adverse effects [1,2].

Lamotrigine and carbamazepine remain important therapeutic options, particularly when individualized considerations such as comorbidities, age, and potential drug interactions are taken into account [3,4].

Individualized therapy, incorporating patient-specific factors, pharmacogenetics, and lifestyle considerations, is essential to maximize efficacy and minimize adverse effects [5,6].

Regular clinical monitoring, including laboratory tests and adverse effect assessment, enhances patient adherence and long-term outcomes [7,8].

For patients with refractory epilepsy, combination therapy—particularly valproate with levetiracetam—offers improved seizure control while maintaining acceptable safety [9,10].

Future research should continue to focus on long-term pharmacovigilance, optimization of combination therapy, and assessment of the psychosocial and economic impact of epilepsy treatment [11,12].

In conclusion, evidence-based individualized treatment strategies, along with systematic monitoring, are crucial for achieving optimal seizure control,

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minimizing adverse effects, and improving overall quality of life for patients with epilepsy [1–12].

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