MODERN APPROACHES TO THE TREATMENT OF EPILEPSY – PHARMACOLOGICAL, SURGICAL, AND NEUROMODULATION STRATEGIES

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Abstract: The management of epilepsy has evolved substantially over the past decades, with the development of new antiepileptic drugs and advanced surgical and neuromodulatory techniques. The primary therapeutic goal is complete seizure control without significant side effects. This article discusses current treatment strategies, including pharmacotherapy, epilepsy surgery, and neuromodulation.

Keywords: epilepsy treatment, antiseizure medications, drug-resistant epilepsy, epilepsy surgery, neuromodulation, VNS, DBS, RNS, ketogenic diet.

Introduction

Approximately 60–70% of patients with epilepsy achieve seizure control with antiseizure medications (ASMs). However, about one-third of patients develop drug-resistant epilepsy, defined as failure to achieve sustained seizure freedom despite adequate trials of two appropriate medications. For these patients, alternative therapeutic approaches are necessary.

Pharmacological Treatment

Antiseizure medications act through various mechanisms, including modulation of voltage-gated sodium and calcium channels, enhancement of GABAergic inhibition, and reduction of glutamatergic excitation. Commonly used drugs include valproate, carbamazepine, lamotrigine, levetiracetam, and topiramate.

Individualized drug selection depends on seizure type, epilepsy syndrome, comorbidities, age, sex, and potential drug interactions.

Surgical Treatment

Epilepsy surgery is considered for patients with focal drug-resistant epilepsy. Resection of the epileptogenic zone, such as anterior temporal lobectomy or lesionectomy, can result in seizure freedom in 60–80% of carefully selected patients. Minimally invasive techniques, including laser interstitial thermal therapy (LITT), have gained popularity.

Neuromodulation Therapies

Neuromodulation offers treatment options for patients who are not surgical candidates. These include:

- Vagus nerve stimulation (VNS)
- Deep brain stimulation (DBS)

- Responsive neurostimulation (RNS)

These methods reduce seizure frequency and improve quality of life.

Dietary Therapies

Ketogenic and modified Atkins diets are effective, particularly in pediatric drug-resistant epilepsy. These diets alter cerebral energy metabolism and reduce neuronal excitability.

Psychosocial Aspects and Quality of Life

Comprehensive care includes psychological support, counseling, and social rehabilitation. Adherence to therapy and education of patients and families play a critical role in long-term outcomes.

Future Perspectives

Emerging therapies include gene therapy, cell-based therapy, and precision medicine approaches based on genetic and molecular profiling.

Conclusion

Modern epilepsy treatment requires a multimodal and individualized approach. Continued research is necessary to improve seizure control and minimize treatment-related adverse effects.

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