

Epilepsy-contemporary approaches to diagnosis and treatment.

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Abstract

Epilepsy is one of the most common chronic neurological disorders, affecting more than 50 million people worldwide. It is characterized by recurrent unprovoked seizures resulting from abnormal electrical activity in the brain. Advances in neuroimaging, electroencephalography, genetics, and pharmacological therapies have significantly improved the diagnosis and management of epilepsy. Early identification of seizure types and epilepsy syndromes is essential for effective treatment and improved quality of life. This article reviews current approaches to the diagnosis, classification, and treatment of epilepsy, highlighting recent developments in precision medicine and emerging therapeutic strategies.

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Keywords: epilepsy, seizures, electroencephalography, antiepileptic drugs, neuroimaging, diagnosis, treatment, neurology.

Epilepsy is a chronic neurological condition characterized by a persistent predisposition to generate epileptic seizures. According to the World Health Organization, epilepsy affects individuals of all ages and represents a significant public health challenge. The disorder can lead to physical injuries, cognitive impairment, psychological distress, and social stigma, adversely affecting patients and their families.

The understanding of epilepsy has evolved considerably over recent decades. Modern diagnostic techniques and innovative treatment options have enabled clinicians to achieve better seizure control and improve long-term outcomes. Nevertheless, approximately one-third of patients continue to experience drug-resistant epilepsy, emphasizing the need for ongoing research and individualized treatment approaches.

Epilepsy may result from various structural, genetic, infectious, metabolic, immune, or unknown causes. Structural abnormalities such as brain tumors, traumatic brain injury, stroke, and congenital malformations are common contributors. Genetic factors play a crucial role in many epilepsy syndromes, particularly those presenting during childhood.

The pathophysiology of epilepsy involves excessive and synchronous neuronal firing within the cerebral cortex. Imbalances between excitatory neurotransmitters, such as glutamate, and inhibitory neurotransmitters, particularly gamma-aminobutyric acid (GABA), contribute to neuronal hyperexcitability and seizure generation. Precision medicine is transforming epilepsy care through individualized treatment strategies based on genetic, clinical, and neurophysiological characteristics. Advances in artificial intelligence are enhancing seizure prediction, EEG interpretation, and diagnostic accuracy. Gene therapy and targeted molecular treatments represent promising areas of research. Novel therapeutic approaches may offer improved outcomes for patients with rare genetic epilepsies and drug-resistant forms of the disease. Wearable seizure-detection devices and telemedicine platforms are also improving patient monitoring and access to specialized neurological care. Epilepsy remains a significant neurological disorder with substantial medical and social implications. Contemporary diagnostic methods, including EEG, advanced neuroimaging, and

genetic testing, have improved diagnostic precision. Modern treatment strategies encompassing antiseizure medications, surgery, neurostimulation, and dietary therapies provide effective seizure control for many patients. Continued research in precision medicine and emerging technologies is expected to further enhance the management and prognosis of epilepsy in the future.

References

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