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A LITERATURE REVIEW ON EPILEPSY

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Abstract

Epilepsy is a chronic neurological disorder characterized by recurrent, unprovoked seizures. It affects approximately 50 million people worldwide, making it one of the most common neurological conditions globally. This literature review aims to provide a comprehensive overview of the current understanding of epilepsy, including its pathophysiology, classification, diagnosis, management, and future research directions. Epilepsy affects both sexes and all ages with worldwide distribution. The prevalence and the incidence of epilepsy are slightly higher in men compared to women and tend to peak in the elderly, reflecting the higher frequency of stroke, neurodegenerative diseases, and tumors in this age-group. Focal seizures are more common than generalized seizures both in children and in adults. The etiology of epilepsy varies according to the sociodemographic characteristics of the affected populations and the extent of the diagnostic workup, but a documented cause is still lacking in about 50% of cases from high-income countries (HIC). The overall prognosis of epilepsy is favourable in the majority of patients when measured by seizure freedom.

Key Words: Epilepsy, Seizures

I. Introduction

Epilepsy is a complex and multifaceted disorder with a significant impact on patients' quality of life. Despite advances in understanding and treatment, epilepsy remains a challenging condition to manage. This review will explore various aspects of epilepsy, from its underlying mechanisms to the latest therapeutic approaches and ongoing research. The epileptic seizures are recurrent paroxysmal events characterized by stereotyped behavioral alterations that reflect the underlying neural mechanisms of the disease. The differential diagnosis of epilepsy encompasses a number of clinical conditions characterized by transient alteration of awareness and/or behavior. In most cases, the disease can be diagnosed through a careful history or by the observation of a seizure. Although an etiologic agent can be identified, still in about one half of cases, the cause is unknown. A variable genetic predisposition to manifest seizures and the differing distribution of some environmental risk factors can explain the heterogeneity of the frequency, course, and consequences of the disease in the world. In addition to the recurrence of seizures, the underlying cause and the adverse effects

of treatment have neurologic, cognitive, psychological, and social consequences that significantly affect the quality of life of the affected individuals and make the disease a complex nosographic entity.

II. Types of Epilepsy

Epilepsy is classified based on the type of seizures experienced by the patient. The International League Against Epilepsy (ILAE) classifies seizures into focal, generalized, and unknown onset. Focal seizures originate in a specific area of the brain, while generalized seizures involve both hemispheres. Unknown onset seizures are those that cannot be clearly classified as either focal or generalized.

Partial seizures

In partial seizures the abnormal electrical discharges start in a localized area of the brain. The symptoms depend on the part of the brain that is affected. These discharges may remain localized. In this case the case is of partial seizures.

If the impulses spread to the whole of the brain seizures become generalized. This is called secondary generalized seizures.

There may be presence of an aura before the seizure. A definite aura is an indication that the seizure is of focal (partial) onset. An aura comes few seconds to minutes before a seizure. There may be a variety of symptoms in the aura including intense fear, butterflies in the stomach, dreamlike experiences, unpleasant smells etc.

The partial seizures are further classified into two types and a third type that is a combination of the two:

Simple partial seizures

In this the patient does not lose consciousness. He or she is able to recount the episode of the seizure. If the motor areas of the brain are affected there may be twitching, starting in a limb or fingers/toes or the face. The twitching may remain there, or spread up the whole limb or become generalized to the whole body. The spreading is called a Jacksonian march (named after Huglings Jackson 1835 - 1911). There may be feelings of numbness, pins and needles or heat/ cold at the limb.

Complex partial seizures

Here the patient loses consciousness. There may not be a complete loss of consciousness, however, and the patient may be slightly aware of the surroundings. There is an aura. Sometimes the seizure occurs with hallucinations and automatic movements like picking at clothes, smacking lips etc. There is a slow recovery after a complex partial seizure, with a period of confusion.

Partial seizures secondary generalized

Both the simple partial seizures and the complex partial seizures may become generalized seizures.

Generalized seizures

The seizure here is generalized from the onset. The impulses start from both sides of the brain simultaneously. The primary generalized seizures are typified by loss of consciousness and the absence of an aura. They may come on abruptly and unexpectedly, and may make the patients fall.

There are six different types of generalized seizures:-

Primary generalized tonic-clonic seizure (GTCS)

This is the most common type of generalized epilepsy. The whole body stiffens (tonic phase) and the person loses consciousness and falls. This is followed by a violent uncontrollable shaking (clonic phase). With this jerking the patient might bite his tongue, pass urine, or sometimes stool. The clonic phase may last several minutes. After the clonic phase consciousness is regained.

Absence seizures

These are short periods of loss of consciousness lasting only a few seconds. They are of sudden onset. Absence seizures are commonly seen in children. There may be a blank stare, brief upward rotation of the eyes and freezing of the individual. The child has no memory of these seizures after they have passed. Earlier these seizures were called petit mal seizures, or pyknolepsy (because they occurred so frequently). The term "petit mal" (little illness) is no longer used.

Myoclonic seizures

This leads to sudden, brief seizures with shock-like muscle contractions leading to jerky movements. They may be single jerks, or jerks repeated over longer periods.

Clonic seizures

These seizures do not have the tonic phase (phase of stiffening of the muscles). There repetitive clonic jerks or uncontrollable shakings. When the frequency diminishes the amplitude of the jerks remain the same.

Tonic seizures

These are generalized seizures with only the tonic phase or stiffening of the muscles. The limbs are fixed in a strange position. There is immediate loss of consciousness. The eyes may deviate to one side of the head. The body may also be twisted.

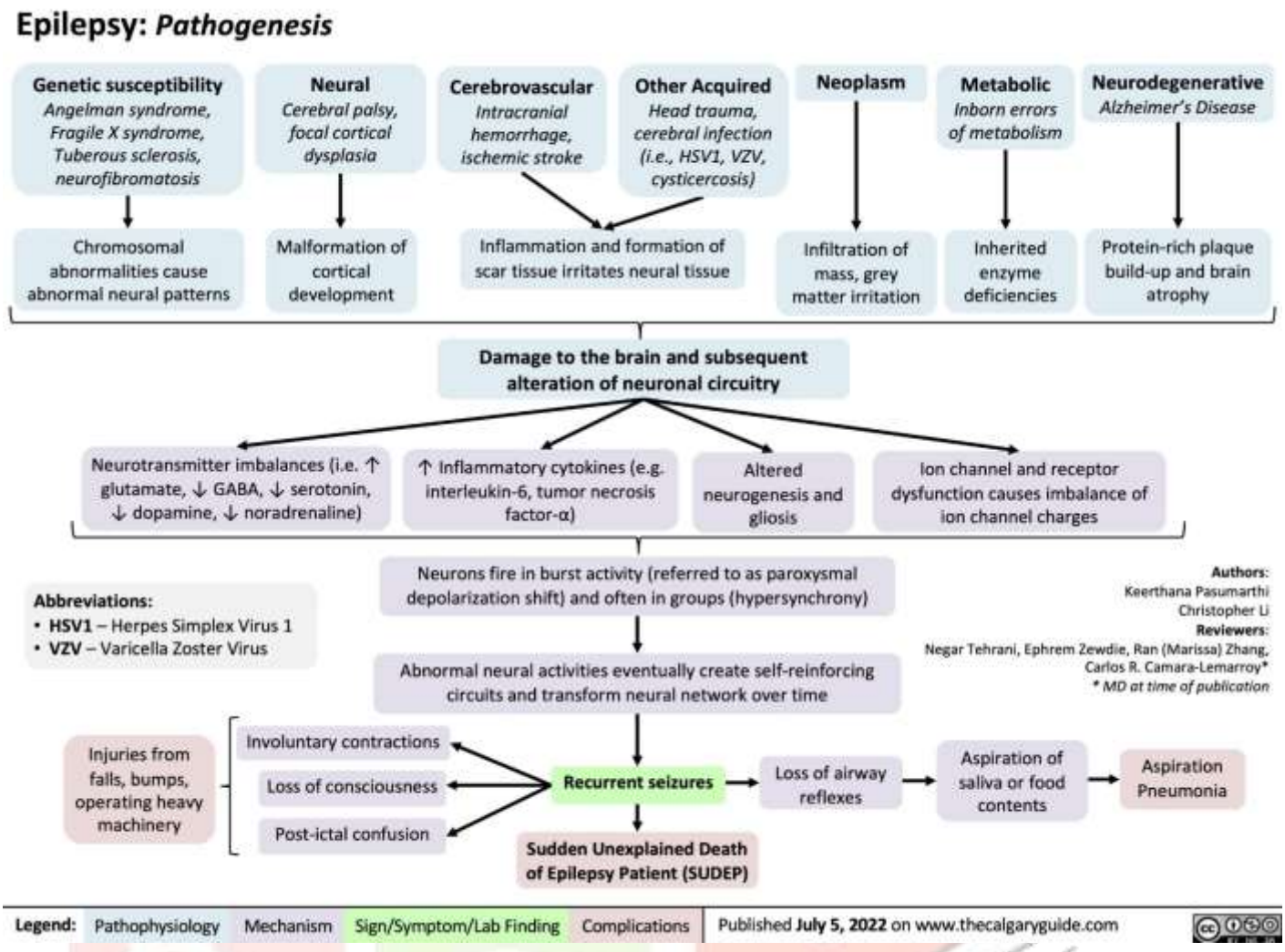
Atonic seizures (astatic seizures)

In this type of seizure there is sudden loss of muscle tone causing the head or a limb to drop and the patient falls as a heap on the floor. These are also thus called "drop attacks". There is loss of consciousness, a sudden onset of seizures.

III. Epidemiology

Epilepsy is a chronic neurological disorder characterised by recurrent unprovoked seizures. It affects an estimated 50 million people worldwide with no socio-demographic boundary. Previous studies demonstrated the point prevalence of epilepsy to be between 4 and 10 per 1,000 persons, making it one of the most prevalent neurological conditions (2–8). The incidence rate of epilepsy is estimated around 50–60 per 100,000 person-years, and up to 8% of people having at least one seizure in their lifetime. Compared to general population, people with recurrent seizures have increased physical and psychiatric comorbidities, healthcare utilisation, and excess mortality. They have reduced quality of life (QoL) , and lower employment and productivity. Epilepsy per se carries a low mortality risk, but significant differences in mortality rates are expected when comparing incidence and prevalence studies, children and adults, and persons with idiopathic and symptomatic seizures. Sudden unexplained death is most frequent in people with generalized tonic-clonic seizures, nocturnal seizures, and drug refractory epilepsy.

IV. Pathophysiology



V. Signs and Symptoms

Seizure symptoms vary depending on the type of seizure. Because epilepsy is caused by certain activity in the brain, seizures can affect any brain process. Seizure symptoms may include:

- Temporary confusion.
- A staring spell.
- Stiff muscles.
- Uncontrollable jerking movements of the arms and legs.
- Loss of consciousness.
- Psychological symptoms such as fear, anxiety or deja vu.

Sometimes people with epilepsy may have changes in their behavior. They also may have symptoms of psychosis.

Most people with epilepsy tend to have the same type of seizure each time. Symptoms are usually similar from episode to episode.

Warning signs of seizures

Some people with focal seizures have warning signs in the moments before a seizure begins. These warning signs are known as aura.

Warning signs might include a feeling in the stomach. Or they might include emotions such as fear. Some people might feel deja vu. Auras also might be a taste or a smell. They might even be visual, such as a steady or flashing light, a color, or a shape. Some people may experience dizziness and loss of balance. And some people may see things that aren't there, known as hallucinations.

VI. Risk Factors

The risk factors for epilepsy in adults are somewhat established and are further discussed in the section, What Causes Epilepsy? There are several known risk factors for epilepsy in adults including head trauma, central nervous system (CNS) infections, such as neurocysticercosis, strokes, both embolic and hemorrhagic, CNS malignancies, particularly cortically based tumors, such as gliomas and metastatic lesions, Alzheimer's disease, and other neurodegenerative conditions. However, the relationship between epilepsy and other conditions, such as subcortical white matter diseases, demyelinating conditions, and certain psychiatric conditions (i.e., depression and schizophrenia), have not been sufficiently characterized.

VII. Diagnosis

To diagnose epilepsy, your healthcare professional reviews your symptoms and medical history. You may have several tests to diagnose epilepsy and to detect the cause of seizures. They may include:

A neurological exam. This exam tests your behavior, movements, mental function and other areas. The exam helps diagnose epilepsy and determine the type of epilepsy you may have.

Blood tests. A blood sample can detect signs of infections, genetic conditions or other conditions that may be associated with seizures.

Genetic testing. In some people with epilepsy, genetic testing may give more information about the condition and how to treat it. Genetic testing is most often performed in children but also may be helpful in some adults with epilepsy.

You also may have brain imaging tests and scans that detect brain changes:

Electroencephalogram (EEG). This is the most common test used to diagnose epilepsy. In this test, small metal discs called electrodes are attached to your scalp with an adhesive or cap. The electrodes record the electrical activity of your brain.

If you have epilepsy, it's common to have changes in the pattern of brain waves. These changes occur even when you're not having a seizure. Your healthcare professional may monitor you on video during an EEG to detect and record any seizures. This may be done while you're awake or asleep. Recording the seizures may help determine what kind of seizures you're having or rule out other conditions.

The test may be done in a healthcare professional's office or the hospital. Or you may have an ambulatory EEG. The EEG records seizure activity over the course of a few days at home.

You may get instructions to do something that can cause seizures, such as getting little sleep prior to the test.

High-density EEG. In a variation of an EEG test, you may have a high-density EEG. For this test, electrodes are placed closer together compared with a conventional EEG. High-density EEG may help more precisely determine which areas of your brain are affected by seizures.

Computerized tomography (CT) scan. A CT scan uses X-rays to obtain cross-sectional images of your brain. CT scans can detect tumors, bleeding or cysts in the brain that might be causing epilepsy.

Magnetic resonance imaging (MRI). An MRI uses powerful magnets and radio waves to create a detailed view of the brain. Like a CT scan, an MRI looks at the structure of the brain to detect what may be causing seizures. But an MRI provides a more detailed look at the brain than a CT scan.

Functional MRI (fMRI). A functional MRI measures the changes in blood flow that occur when specific parts of the brain are working. This test may be used before surgery to identify the exact locations of critical functions, such as speech and movement. This allows surgeons to avoid those areas while operating.

Positron emission tomography (PET). PET scans use a small amount of low-dose radioactive material. The material is injected into a vein to help visualize metabolic activity of the brain and detect changes. Areas of the brain with low metabolism may indicate places where seizures occur.

Single-photon emission computerized tomography (SPECT). This type of test is used if MRI and EEG didn't pinpoint the location in the brain where the seizures start.

A SPECT test uses a small amount of low-dose radioactive material. The material is injected into a vein to create a detailed, 3D map of blood flow during seizures. Areas of higher than typical blood flow may indicate areas where seizures occur.

Another type of SPECT test called subtraction ictal SPECT co-registered to MRI (SISCOM) may provide even more-detailed results. The test overlaps the SPECT results with brain MRI results.

Neuropsychological tests. These tests assess thinking, memory and speech skills. The test results help determine which areas of the brain are affected by seizures.

Along with your test results, a combination of other techniques may be used to help pinpoint where in the brain seizures start:

Statistical parametric mapping (SPM). SPM looks at the areas of the brain with increased blood flow during seizures. It's compared to the same areas of the brains of people who don't have seizures. This provides information about where seizures begin.

Electrical source imaging (ESI). ESI is a technique that takes EEG data and projects it onto an MRI of the brain. This is done to show areas where seizures are occurring. This technique provides more-precise detail than does EEG alone.

Magnetoencephalography (MEG). MEG measures the magnetic fields produced by brain activity. This helps find the potential areas where seizures start. MEG can be more accurate than EEG because the skull and tissue surrounding the brain interfere less with magnetic fields. MEG and MRI together provide images that show areas of the brain both affected by seizures and not affected by seizures.

VIII. Management

Pharmacological Treatment

Anti-epileptic drugs (AEDs) are the primary treatment for epilepsy. The choice of AED depends on the type of seizures, the patient’s age, comorbid conditions, and potential side effects. Commonly used AEDs include valproate, lamotrigine, and levetiracetam. Despite the availability of multiple AEDs, about one-third of patients remain refractory to medical treatment.

Surgical Treatment

For patients with drug-resistant epilepsy, surgical intervention may be considered. Procedures such as lobectomy, lesionectomy, and corpus callosotomy can be effective in controlling seizures. Advances in surgical techniques, including the use of robotic-assisted surgery and laser interstitial thermal therapy (LITT), have improved outcomes for these patients.

Neurostimulation

Neurostimulation techniques, including vagus nerve stimulation (VNS), responsive neurostimulation (RNS), and deep brain stimulation (DBS), offer alternative treatment options for patients with refractory epilepsy. These methods modulate brain activity to reduce the frequency and severity of seizures.

Lifestyle and Supportive Therapies

Lifestyle modifications, such as maintaining a regular sleep schedule, managing stress, and avoiding seizure triggers, are crucial for epilepsy management. Supportive therapies, including psychological 762ounselling, occupational therapy, and social support, play a vital role in improving the quality of life for epilepsy patients.

Future Directions

Precision Medicine

Advances in genetics and personalized medicine hold promise for more effective epilepsy treatments. Understanding the genetic basis of epilepsy can lead to targeted therapies that address the underlying causes of the disorder.

Innovative Therapies

Research into novel therapies, such as gene therapy, stem cell therapy, and novel drug delivery systems, is ongoing. These approaches aim to provide more effective and less invasive treatment options for epilepsy patients.

Improved Diagnostic Techniques

Developments in neuroimaging and electrophysiological techniques are enhancing the accuracy of epilepsy diagnosis. Techniques like magnetoencephalography (MEG) and high-density EEG offer more detailed insights into brain activity and seizure localization.

Conclusion

Epilepsy remains a significant medical challenge, with ongoing research continually improving our understanding and management of the disorder. Advances in genetics, neuroimaging, and therapeutic approaches offer hope for better outcomes for epilepsy patients. Continued research and innovation are essential to fully unravel the complexities of epilepsy and develop more effective treatments.

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(Note: The references listed are representative of typical academic sources on the topic. In an actual literature review, these would be drawn from a comprehensive survey of the current literature.