

NEUROSCIENCE

4. CENTRAL NERVOUS SYSTEM: DISEASES & DISORDERS

4.1. Overview of Nervous System Disorders

To review, the spinal cord transmits sensory reception from the peripheral nervous system. It also conducts motor information to the body's skeletal muscles, cardiac muscles, smooth muscles, and glands. There are 31 pairs of spinal nerves along the spinal cord. These nerves each contain both sensory and motor axons. The spinal cord is protected by vertebrae and connects the peripheral nervous system to the brain, and it acts as a minor coordinating center. The brain allows the body to function. The brain is protected by the skull however, if the brain is damaged, the results to the human body can be very consequential. A central nervous system disease can affect either the spinal cord (myelopathy) or brain (encephalopathy), both of which are part of the central nervous system. The nervous system is a complex, sophisticated system that regulates and coordinates body activities. It is made up of two major divisions, including the following:

- **Central nervous system** - This consists of the brain and spinal cord
- **Peripheral nervous system** - This consists of all other neural elements

In addition to the brain and spinal cord, principal organs of the nervous system include the following; eyes, ears, sense of taste, sense of smell, and the sensory receptors located in the skin, joints, muscles, and other parts of the body.

4.2. Signs and Symptoms of Nervous System Disorders

The following are the most common general signs and symptoms of a nervous system disorder. However, each individual may experience symptoms differently. Symptoms may include:

- Persistent or sudden onset of a headache
- A headache that changes or is different
- Loss of feeling or tingling

- Weakness or loss of muscle strength
- Sudden loss of sight or double vision
- Memory loss
- Impaired mental ability
- Lack of coordination
- Muscle rigidity
- Tremors and seizures
- Back pain which radiates to the feet, toes, or other parts of the body
- Muscle wasting and slurred speech

The symptoms of a nervous system disorder may resemble other medical conditions or problems. Doctors who treat nervous system disorders may have to spend a lot of time working with the patient before making a probable diagnosis of the specific condition. Many times, this involves performing numerous tests to eliminate other conditions, so that the probable diagnosis can be made.

- **Neurology** - The branch of medicine that manages nervous system disorders is called neurology. The medical doctors who treat nervous system disorders are called neurologists.
- **Neurological surgery** - The branch of medicine that provides surgical intervention for nervous system disorders is called neurosurgery, or neurological surgery. Surgeons who operate as a treatment team for nervous system disorders are called neurological surgeons or neurosurgeons.
- **Rehabilitation for neurological disorders** - The branch of medicine that provides rehabilitative care for patients with nervous system disorders is called physical medicine and rehabilitation. Doctors who work with patients in the rehabilitation process are called physiatrists.

4.3. Disorders of the Nervous System

Disorders of the nervous system may involve the following:

- **Vascular disorders** - Such as stroke, transient ischemic attack (TIA), subarachnoid hemorrhage, subdural hemorrhage and hematoma, and extradural hemorrhage
- **Infections** - Such as meningitis, encephalitis, polio, and epidural abscess
- **Structural disorders** - Such as brain or spinal cord injury, Bell's palsy, cervical spondylosis, carpal tunnel syndrome, brain or spinal cord tumors, peripheral neuropathy, and Guillain-Barré syndrome

- **Functional disorders** - Such as headaches, epilepsy, dizziness, and neuralgia
- **Degeneration** - Such as Parkinson's disease, multiple sclerosis, amyotrophic lateral sclerosis (ALS), Huntington's chorea, and Alzheimer's disease

With traumas, any type of traumatic brain injury (TBI) or injury done to the spinal cord can result in a wide spectrum of disabilities in a person. Depending on the section of the brain or spinal cord that suffers the trauma, the outcome may be anticipated. Degenerative spinal disorders involve a loss of function in the spine. Pressure on the spinal cord and nerves may be associated with herniation or disc displacement. Brain degeneration also causes central nervous system diseases. Studies have shown that obese people may have severe degeneration in the brain due to loss of tissue affecting cognition. Common structural defects include birth defects, anencephaly, hypospadias, and spina bifida. Children born with structural defects may have malformed limbs, heart problems, and facial abnormalities.

A tumor is an abnormal growth of body tissue. In the beginning, tumors can be noncancerous, but if they become malignant, they are cancerous. In general, they appear when there is a problem with cellular division. Problems with the body's immune system can lead to tumors. An autoimmune disorder is a condition wherein the immune system attacks and destroys healthy body tissue. This is caused by a loss of tolerance to proteins in the body, resulting in immune cells recognizing these as foreign and directing an immune response against them. A stroke is an interruption of the blood supply to the brain. Approximately every 40 seconds, someone in the U.S. has a stroke. This can happen when a blood vessel is blocked by a blood clot or when a blood vessel ruptures, causing blood to leak to the brain. If the brain cannot get enough oxygen and blood, brain cells can die, leading to permanent damage.

4.4. Diseases

Catalepsy is a nervous disorder characterized by immobility and muscular rigidity, along with a decreased sensitivity to pain. Catalepsy is considered a symptom of serious diseases of the nervous system (e.g., Parkinson's disease, Epilepsy, etc.) rather than a disease by itself. Cataleptic fits can range in duration from several minutes to weeks. Catalepsy often responds to Benzodiazepines (e.g., Lorazepam) in pill & I.V. form. Epilepsy is an unpredictable, serious, and potentially fatal disorder of the nervous system, thought to be the result of faulty electrical activity in the brain. Epileptic seizures result from abnormal, excessive, or

hypersynchronous neuronal activity in the brain. About 50 million people worldwide have epilepsy, and nearly 80% of epilepsy occurs in developing countries. Epilepsy becomes more common as people age. Onset of new cases occurs most frequently in infants and the elderly. Epileptic seizures may occur in recovering patients as a consequence of brain surgery. Encephalitis is an inflammation of the brain. It is usually caused by a foreign substance or a viral infection. Symptoms of this disease include headache, neck pain, drowsiness, nausea, and fever. If caused by the West Nile virus, it may be lethal to humans, as well as birds and horses.

Meningitis is an inflammation of the meninges (membranes) of the brain and spinal cord. It is most often caused by a bacterial or viral infection. Fever, vomiting, and a stiff neck are all symptoms of meningitis. Migraines are chronic, often debilitating neurological disorder characterized by recurrent moderate to severe headaches, often in association with a number of autonomic nervous system symptoms. Arachnoid cysts are cerebrospinal fluid covered by arachnoidal cells that may develop on the brain or spinal cord. They are a congenital disorder, and in some cases may not show symptoms. However, if there is a large cyst, symptoms may include headache, seizures, ataxia (lack of muscle control), hemiparesis, and several others. Macrocephaly and ADHD are common among children, while presenile dementia, hydrocephalus (an abnormality of the dynamics of the cerebrospinal fluid), and urinary incontinence are symptoms for elderly patients, aged 65 and older. Huntington's disease is a degenerative neurological disorder that is inherited. Degeneration of neuronal cells occurs throughout the brain, especially in the striatum. There is a progressive decline that results in abnormal movements. Statistics show that Huntington's disease may affect 10 per 100,000 people of Western European descent.

Alzheimer's disease is a neurodegenerative disease typically found in people over the age of 65 years. Worldwide, approximately 24 million people have dementia; 60% of these cases are due to Alzheimer's. The ultimate cause is unknown. The clinical sign of Alzheimer's is progressive cognition deterioration. Attention Deficit Hyperactivity Disorder, ADHD is now largely considered to be a genuine organic disorder of the nervous system, according to the United States government. ADHD, which in severe cases can be debilitating, has symptoms thought to be caused by structural as well as biochemical imbalances in the brain in particular, low levels of the neurotransmitters dopamine and norepinephrine, which are responsible for controlling and maintaining attention and movement. Many people with ADHD continue to have symptoms well into adulthood. Additionally, ADHD like symptoms in childhood have also been associated with a very famous case of

young onset Parkinson's disease. In his 2002 autobiography, Hollywood star-turned Parkinson's disease activist Michael J. Fox describes a childhood filled with hyperactive behaviors and discipline problems as well as a doctor's advice that he go on some form of ADHD drug therapy, as far back as the early 1960s. Also of note is an increased risk of the development of Dementia with Lewy bodies, or (DLB), a progressive, and often fatal, neurological disease with symptoms similar to both Alzheimer's disease and Parkinson's disease, which often occurs in people over age 65. Parkinson's disease, or PD, is a progressive illness of the nervous system caused by the death of dopamine-producing brain cells that affect motor skills and speech. Symptoms may include bradykinesia (slow physical movement), muscle rigidity, and tremors. Behavior, thinking, sensation disorders, and the sometimes co-morbid skin condition Seborrheic dermatitis are just some of PD's numerous nonmotor symptoms. Interestingly, Parkinson's disease & Attention deficit/hyperactivity disorder (ADHD) appear to have some connection to one another, as both nervous system disorders involve lower than normal levels of the brain chemical dopamine in different areas of the brain, the Substantia nigra in Parkinson's disease and the Frontal lobe in ADHD.

Tourette's syndrome is an inherited neurological disorder. Early onset may be during childhood, and it is characterized by physical and verbal tics. The exact cause of Tourette's, other than genetic factors, is unknown. Multiple Sclerosis (MS) is a chronic, inflammatory demyelinating disease, meaning that the myelin sheath of neurons is damaged. Symptoms of MS include visual and sensation problems, muscle weakness, and depression. Infectious diseases are transmitted in several ways. Some of these infections may affect the brain or spinal cord directly. Generally, an infection is a disease that is caused by the invasion of a microorganism or virus.