

Central nervous system

By

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Clinical Medicine & Pathology 316

7th Lecture

Lecture outline

- Review of structure & function.
- Symptoms, signs & tests.
- Specific diseases.

Review of structure & function

- **What are the two main components of the CNS?**
- **The brain and spinal cord.**
- The central nervous system (CNS) is the part of the nervous system that integrates the information that it receives from, and coordinates the activity of all parts of the body.
- Some classifications also include the retina and the cranial nerves in the CNS. Together with the peripheral nervous system, it has a fundamental role in the control of behavior.
- **What does the brain control?**
- The brain controls all functionality of the body including physical movement, behavioral actions, and psychological reaction.

Review of structure & function

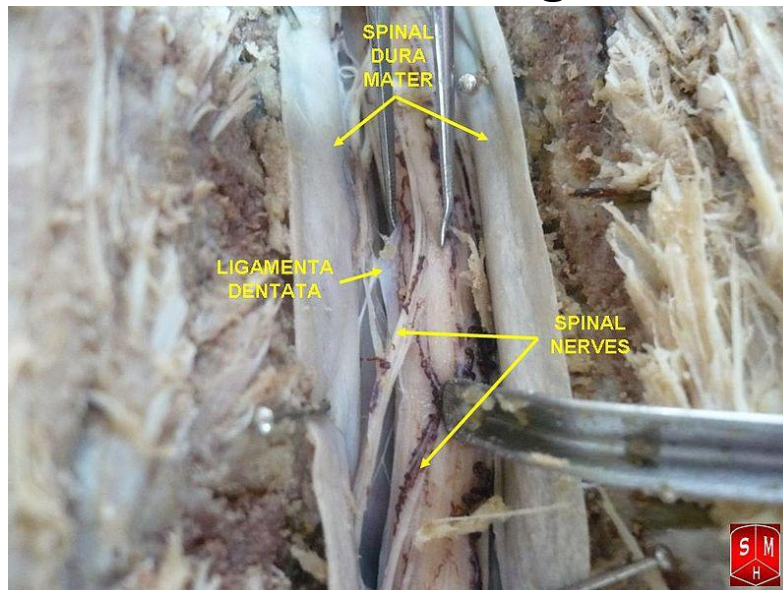
- The brain acts on the rest of the body either by generating patterns of muscle activity or by driving secretion of chemicals called hormones.
- This centralized control allows rapid and coordinated responses to changes in the environment. Some basic types of responsiveness such as reflexes can be mediated by the spinal cord or peripheral ganglia.
- Sophisticated purposeful control of behavior based on complex sensory input requires the information-integrating capabilities of a centralized brain.
- The brain controls movement, physiological and psychological actions as well as behavioral changes.

Review of structure & function

- **What functions do the spinal cord serve?**

- The spinal cord has three major functions:

1. Serve as a conduit for motor information, which travels down the spinal cord.
2. Serve as a conduit for sensory information, which travels up the spinal cord.
3. Serve as a center for coordinating certain reflexes.



Symptoms, signs & tests

- **What are the most common symptoms of the central nervous system disease?**
 1. Headache.
 2. Loss of motor function.
 3. Sensory loss.
 4. Seizures.
 5. Disturbances in intellectual or memory capabilities.
 6. Loss of muscle strength.
 7. Difficulty speaking.

Symptoms, signs & tests

- **What medical examinations can be done to evaluate the possibility of central nervous system disease?**
 - Examination of the motor and sensory systems as well as testing the cognitive function.
 - The motor system examination involves observation of the patient's posture, and symmetry of muscle mass, as well as testing for muscle strength, coordination, and quality of reflexes.
 - Examination of the sensory system entails careful history of abnormal sensations and testing for diminished or absent sensory perception on various areas of the body.

Symptoms, signs & tests

- **What testing methods or tools are available?**

1. **Laboratory test:**

- The most important test that can be utilized to evaluate the central nervous system disease is the analysis of cerebrospinal fluid.
- The fluid is withdrawn from the spinal cord then tested microscopically for the presence of leukocytes, red blood cells, neoplastic cells, and microorganisms.

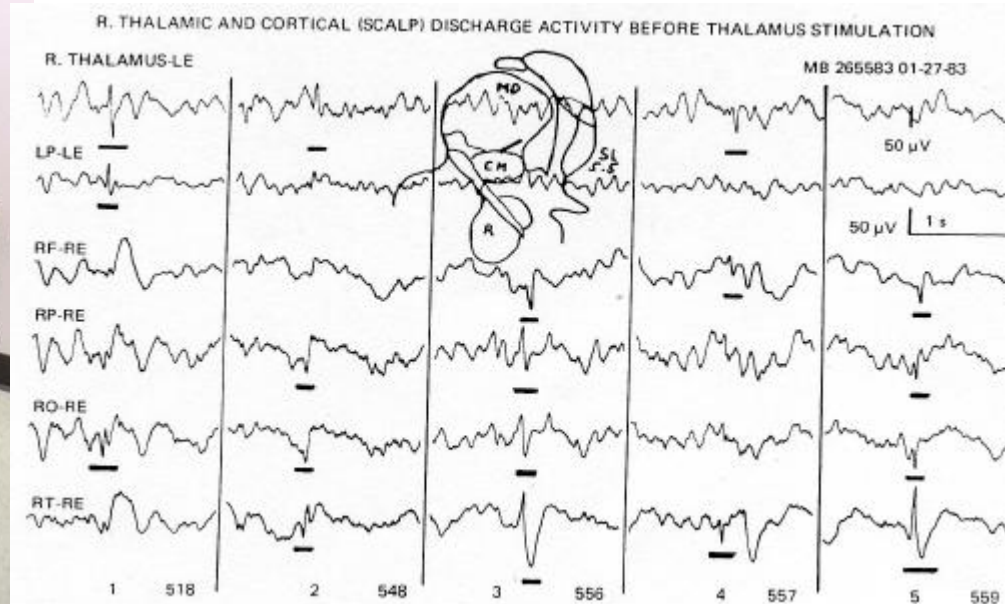
2. **Radiologic procedures:**

- A number of different radiologic procedures are involved in the examination of CNS disease including, x-ray, CT, US, MRI & fMRI.

Symptoms, signs & tests

3. Electroencephalogram (EEG):

- EEG is a device for evaluating electrical activity in various areas of the brain. How does it work?
- Normal neurons discharge electrically in certain known patterns, whereas abnormalities in patterns denote neuronal disturbances, which may be predicative of injury in specific areas.



Specific diseases

1. Genetic/developmental diseases:

- **Malformations:**

- The result of harmful forces acting upon the embryonic or fetal brain roughly within the first half of gestation.
- It could result also from infection or traumatic insult to the brain.
- Individuals with brain malformations are often severely retarded, unable to care for themselves, confined to hospitals.
- Any example?
- Down's syndrome is one example and caused by a chromosomal abnormality. Any more?
- Spina bifida in which the posterior arches and spines of some vertebrae are absent.

Specific diseases

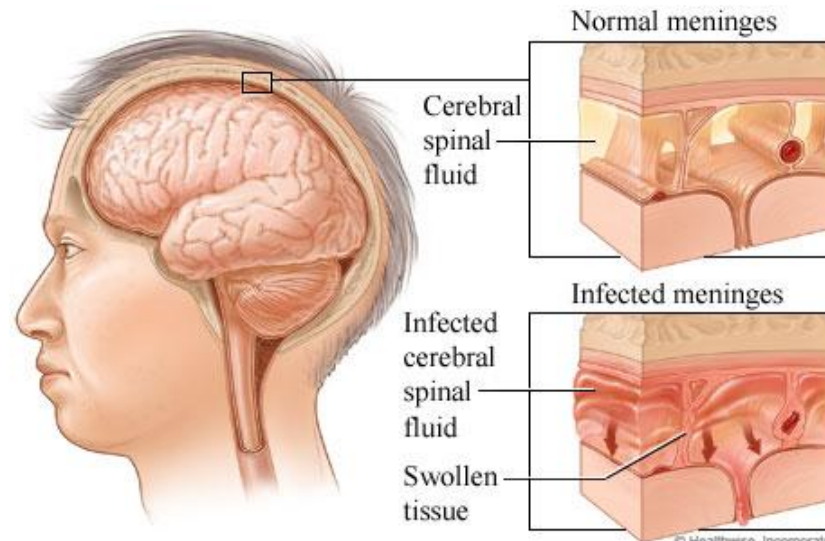
- **Destructive brain lesions:**
 - These lesions occur in the last half of gestational life or during the first 2 years after birth.
 - Injuries to the brain after formation result in destructive lesions with actual loss of brain substance in various areas.
 - Infections are the common cause of such lesions especially upon delivery or for new born babies.
 - The severity of the defect will depend upon the stage of development at the time of insult with motor retardation and occasional mental retardation as the main problems.

Specific diseases

2. Inflammatory/degenerative diseases:

- **Meningitis:**

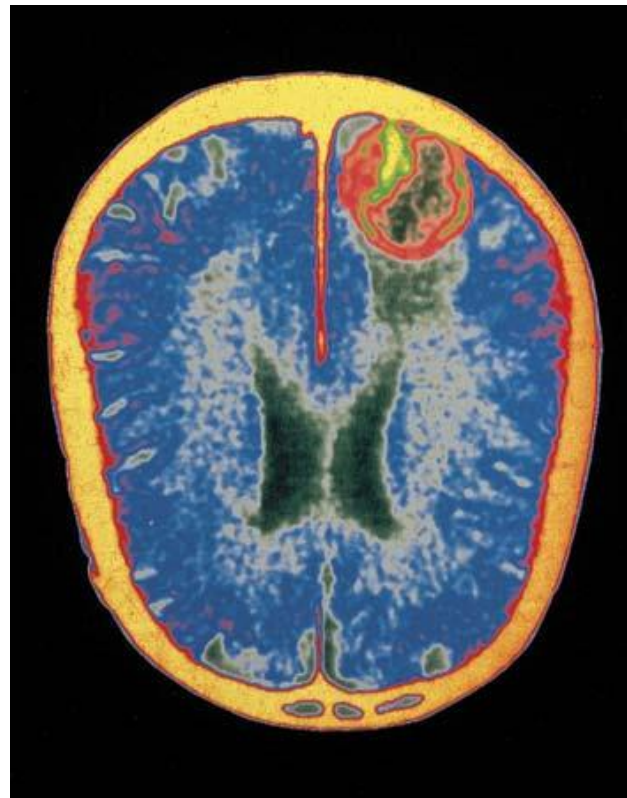
- An inflammation of the meninges (membranes) of the brain and spinal cord. It is most often caused by a bacterial or viral infection. Fever, vomiting, and a stiff neck are all symptoms of meningitis.
- It occurs by itself but may be associated with other infections such as pneumonia.



Specific diseases

- **Encephalitis:**

- Encephalitis is an inflammation of the brain. It is usually caused by a foreign substance or a viral infection. Symptoms for this disease include: headache, neck pain, drowsiness, nausea, and fever. If caused by the West Nile virus, it may be lethal to humans.



Specific diseases

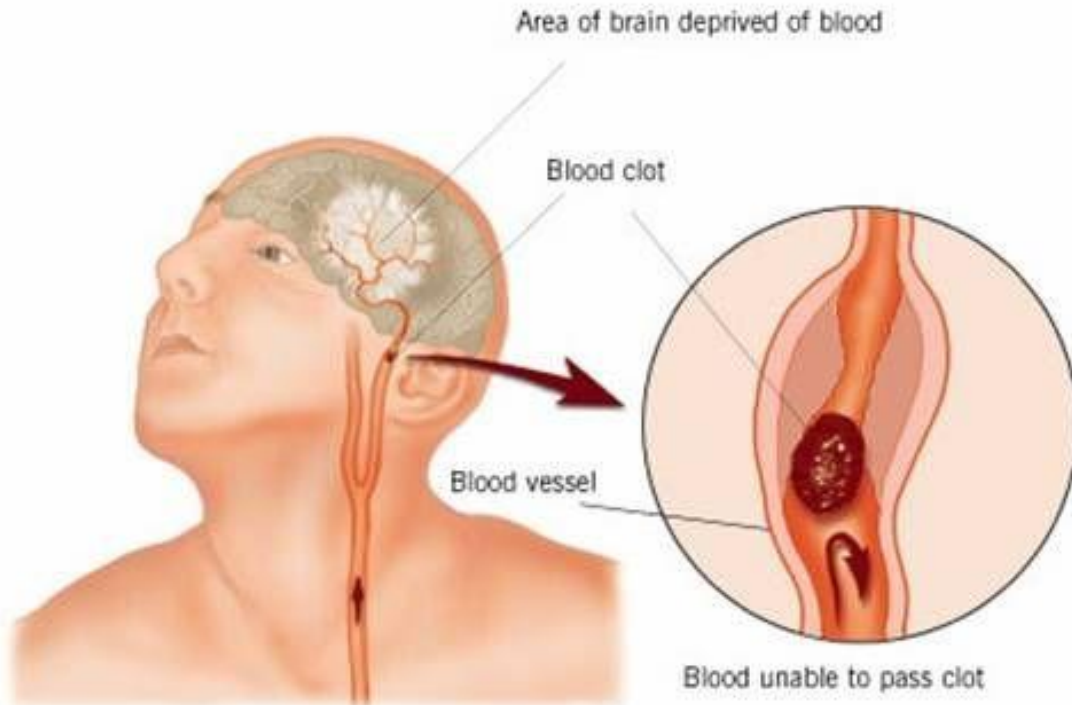
- **Myelitis:**
 - A disease involving inflammation of the spinal cord, which disrupts central nervous system functions linking the brain and limbs.
 - Symptoms vary by region of the CNS affected, and include fever, headaches, tingling, pain or loss of feeling, and may extend to central or peripheral paresis and loss of bladder control.



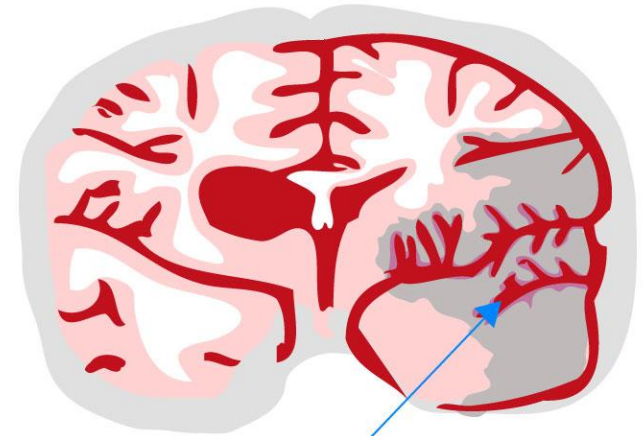
Specific diseases

- **Cerebrovascular accident (Stroke):**
 - The rapid loss of brain function(s) due to disturbance in the blood supply to the brain.
 - This can be due to lack of blood flow caused by blockage (thrombosis, arterial embolism), or a hemorrhage (leakage of blood).
 - As a result, the affected area of the brain cannot function, which might result in an inability to move one or more limbs on one side of the body, inability to understand or formulate speech, or an inability to see one side of the visual field.
 - A stroke is a medical emergency and can cause permanent neurological damage, complications, and death.

Specific diseases



STROKE



Blood vessel
bursting in brain



Specific diseases

- **Multiple sclerosis:**
 - 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.
 - Disease onset usually occurs in young adults, and it is more common in women.
 - MS affects the ability of nerve cells in the brain and spinal cord to communicate with each other effectively.
 - The name *multiple sclerosis* refers to scars (scleroses—better known as plaques or lesions) particularly in the white matter of the brain and spinal cord.

Specific diseases

Main symptoms of Multiple sclerosis

Central:

- Fatigue
- Cognitive impairment
- Depression
- Unstable mood

Visual:

- Nystagmus
- Optic neuritis
- Diplopia

Speech:

- Dysarthria

Throat:

- Dysphagia

Musculoskeletal:

- Weakness
- Spasms
- Ataxia

Sensation:

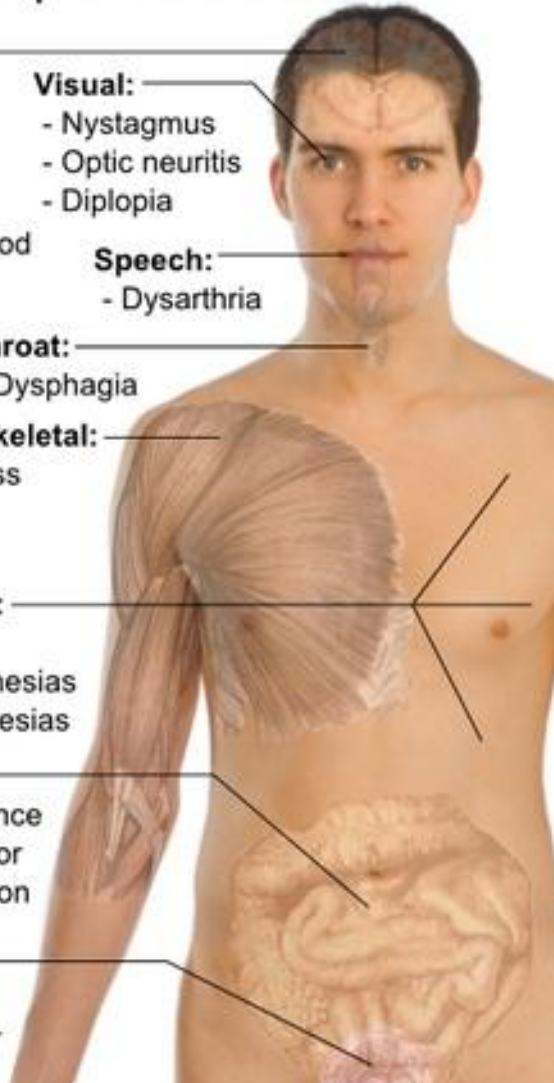
- Pain
- Hypoesthesias
- Paraesthesias

Bowel:

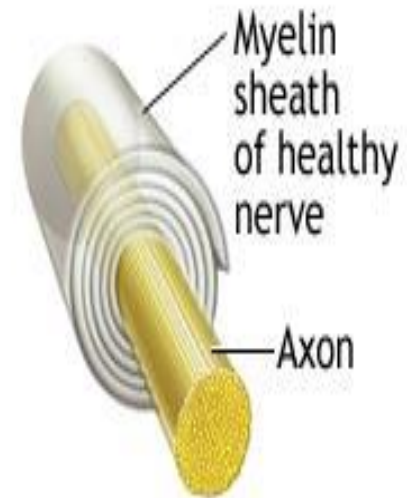
- Incontinence
- Diarrhea or constipation

Urinary:

- Incontinence
- Frequency or retention



Central nervous system (brain and spinal cord)



In multiple sclerosis the myelin sheath, which is a covering that wraps around the axon, is destroyed with inflammation and scarring

Specific diseases

- **Parkinson's disease:**
 - Parkinson's affects the motor skills and speech. Symptoms may include bradykinesia (slow physical movement), muscle rigidity, and tremors. Behavior, thinking, and sensation disorders are non-motor symptoms.
- **Alzheimer's disease:**
 - Alzheimer's 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.

Finally done...

