Tikrit University

College of Nursing

Basic Nursing Sciences

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Adult Nursing

Introduction to Nervous System

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Overview

Review of Anatomy and Physiology

Structures and Functions of the Nervous System

Overview

A Central nervous system (CNS)

1. Brain

2. Spinal cord

B Peripheral nervous system (PNS)

1. Cranial nerves

2. Spinal nerves

3. Autonomic nervous system (ANS)

a. Sympathetic nervous system: mediated by neurotransmitter norepinephrine

b. Parasympathetic nervous system: mediated by neurotransmitter acetylcholine

Neurons

Nerve cells: basic structural and functional units

A -Types

1. Sensory (afferent) neurons: transmit impulses to spinal cord or brain

2. Moto neurons (efferent): transmit impulses away from brain or spinal cord to muscles or glands

a. Upper motor neurons: located in CNS; destruction causes loss of voluntary control, muscle spasticity, and hyperactive reflexes

b. Lower motor neurons: cranial and spinal efferent neurons that lie in gray matter of spinal cord and extend into the peripheral nervous system and end at myoneural junctions in muscles; destruction causes loss of voluntary control, muscle flaccidity, and loss of reflexes

B Impulse transmission

1. Cell body: contains a nucleus and other cytoplasmic matter
2. Dendrite: carry impulses toward cell body
3. Axon: carries impulse away from cell body
4. Myelin: multiple, dense layers of membrane around an axon or dendrite; myelinated nerve fibers transmit nerve impulses more rapidly than nonmyelinated fibers
5. Nerve impulses are excitatory or inhibitory
6. Synapse

a. Point of contact between axon of one cell and dendrites of another

b. Axons enlarge to form synaptic terminals that secrete neurotransmitters

Brain

A General considerations

1. Has large blood supply and high oxygen consumption
2. Uses glucose for energy metabolism, so hypoglycemia can alter brain function
3. Protected by blood-brain barrier, a selective filtration system that isolates the brain from certain substances in the general circulation
4. Basic tissue types: neuron cell aggregations (gray matter) and tracts of myelinated fibers (white matter)

B **Brainstem**

1. Consists of medulla, pons, and midbrain

2. Conducts impulses between spinal cord and brain; most motor and sensory fibers decussate (cross over) in medulla

3. Contains reflex centers for heart, respirations, vomiting, coughing, and swallowing; controls blood vessel diameter

4. Cranial nerves III through XII originate in brainstem

C Cerebellum: exerts synergic control over skeletal muscles, producing smooth, precise movements; coordinates skeletal muscle contractions; promotes posture, equilibrium, and balance

D Diencephalon

1. Thalamus

a. Crudely translates sensory impulses into sensations but does not localize them

b. Processes motor information from cerebral cortex and cerebellum and projects it back to motor cortex

c. Contributes to emotional component of sensations (pleasant or unpleasant)

2. Hypothalamus

a. Part of neural path by which emotions and other cerebral functions can alter vital, automatic functions (e.g., heartbeat, blood pressure, peristalsis, and secretion by glands)

b. Secretes neuropeptides that influence secretion of various anterior pituitary hormones

c. Produces antidiuretic hormone (ADH) and oxytocin, which are

secreted by the posterior pituitary

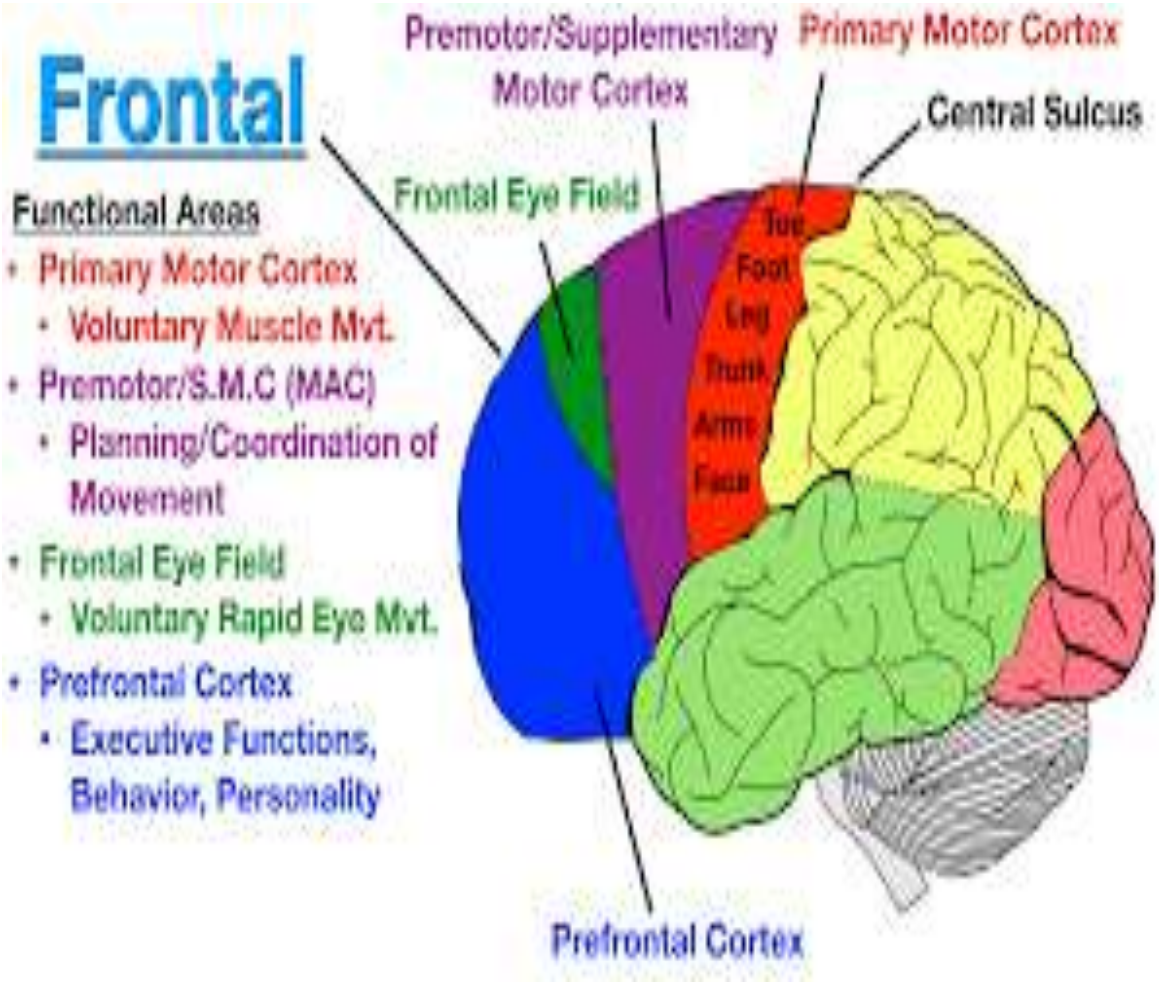
d. Contains appetite center and satiety center

e. Serves as a heat-regulating center by relaying impulses to lower autonomic centers for vasoconstriction, vasodilation, and sweating, and to somatic centers for shivering

f. Maintains waking state; part of arousal or alerting neural pathway

3. Optic chiasm: point of crossing over (decussation) of optic nerve fibers

E Cerebral cortex: consists of multiple lobes divided into two hemispheres covered by gray matter forming folds (convolutions) composed of hills (gyri) and valleys (sulci) (Figure -1: Cerebral cortex)



1. Frontal lobe

a. Influences abstract thinking, sense of humor, and uniqueness of personality

b. Controls contraction of skeletal muscles and synchronization of muscular movements

c. Exerts control over hypothalamus; influences basic biorhythms

d. Controls muscular movements necessary for speech (Broca area)

2. Parietal lobes

a. Translate nerve impulses into sensations (e.g., touch, temperature)

b. Interpret sensations; provide appreciation of size, shape, texture, and weight

c. Interpret sense of taste

3. Temporal lobes

a. Translate nerve impulses into sensations of sound and interpret sounds (Wernicke's area; usually in dominant hemisphere)

b. Interpret sense of smell

c. Control behavior patterns

4. Occipital lobe

a. Interprets sense of vision

b. Provides appreciation of size, shape, and color

F- Brain and spinal cord protection

1. Vertebrae around cord; cranial bones around brain

2. Meninges

a. Dura mater: white fibrous tissue, outer layer

b. Arachnoid: "cobwebby" middle layer

c. Pia mater: innermost layer; adheres to outer surface of cord and brain; contains blood vessels

3. Spaces

a. Subarachnoid space: around brain and cord between arachnoid and pia mater

b. Subdural space: between dura mater and arachnoid

c. Epidural space: between dura mater and cranial bones

4. Ventricles and cerebral aqueduct inside brain; four cavities known as first, second, third, and fourth ventricles

a. Cerebrospinal fluid (CFS) formed by plasma filtering from network of capillaries (choroid plexus) in each ventricle

b. CFS circulates throughout ventricles in the brain and subarachnoid space and returns to blood via venous sinuses of brain