Overview of Anatomy and Physiology

Structural divisions
- Central nervous system (CNS)
  - Brain and spinal cord
- Peripheral nervous system
  - Somatic nervous system
    - Sends messages from the CNS to the skeletal muscles; voluntary
  - Autonomic nervous system
    - Sends messages from the CNS to the smooth muscle, cardiac muscle, and certain glands; involuntary

Overview of Anatomy and Physiology

Cells of the nervous system
- Neuron
- Neuromuscular junction
- Neurotransmitters
  - Acetylcholine; norepinephrine; dopamine; serotonin
- Neuron coverings

Figure 54-1

Overview of Anatomy and Physiology

Central nervous system
- Brain
  - Cerebrum
  - Diencephalon
  - Cerebellum
  - Brain stem
    - Midbrain; pons; medulla oblongata; coverings of the brain and spinal cord; ventricles
  - Spinal cord
Figure 54-2

Overview of Anatomy and Physiology

Peripheral nervous system
- Spinal nerves
- Cranial nerves
- Autonomic nervous system
  - Sympathetic nervous system
  - Parasympathetic nervous system

Figure 54-4

Overview of Anatomy and Physiology

Effects of normal aging on the nervous system
- Loss of brain weight
- Loss of neurons
- Reduction in cerebral blood flow
- Decrease in brain metabolism and oxygen utilization
- Decreased blood supply to spinal cord causes decreased reflexes

Overview of Anatomy and Physiology

Prevention of neurological problems
- Avoid drug and alcohol use
- Safe use of motor vehicles
- Safe swimming practices
- Safe handling and storage of firearms
- Use of hardhats in dangerous construction areas
- Use of protective padding as needed for sports

Assessment of the Neurological System

History
• Mental status
  • Level of consciousness
    - Glasgow coma scale
  • Language and speech
  • Cranial nerve function
  • Motor function
  • Sensory and perceptual status
  • Laboratory and Diagnostic Examinations
  • Blood and urine
    - Culture
    - Drug screens
    - Arterial blood gases
  • Cerebrospinal fluid
  • Computed tomography (CT)
  • Brain scan
  • MRI scan
  • PET scan
  • Lumbar puncture
  • Figure 54-6
  • Laboratory and Diagnostic Examinations
  • Electroencephalogram
  • Myelogram
Angiogram
Carotid duplex
Digital subtraction angiography
Electromyogram
Echoencephalogram
Common Disorders of the Neurological System

Headaches
  ▪ Etiology/pathophysiology
    ▪ Skull and brain tissues are not able to feel sensory pain
    ▪ Vascular headaches
      ▪ Migraine
      ▪ Cluster
      ▪ Hypertensive
    ▪ Tension headaches
    ▪ Traction-inflammation headaches

Common Disorders of the Neurological System

Headaches (continued)
  ▪ Clinical manifestations/assessment
    ▪ Head pain
    ▪ Migraine headaches
      ▪ Prodromal (early sign/symptom)
        ▪ Visual field defects, unusual smells or sounds, disorientation, paresthesias
      ▪ During headache
        ▪ Nausea, vomiting, light sensitivity, chilliness, fatigue, irritability, diaphoresis, edema

Common Disorders of the Neurological System
• Headaches 
  (continued)
  • Medical management/nursing interventions
    • Pharmacological management
      • Migraine headaches
        o Aspirin, acetaminophen, ibuprofen
        o Ergotamine tartrate
        o Codeine; Inderal
    • Dietary recommendations
      • Limit MSG, vinegar, chocolate, yogurt, alcohol, fermented or
        marinated foods, ripened cheese, cured sandwich meat, caffeine, and
        pork
    • Psychotherapy

• Common Disorders of the Neurological System

• Headaches 
  (continued)
  • Medical management/nursing interventions
    • Cluster headaches
      • Narcotic analgesics
    • Tension headaches
      • Non-narcotic analgesics
    • Traction-inflammatory headaches
      • Treat cause
  • Comfort measures
    • Cold packs to forehead or base of skull
    • Pressure to temporal arteries
    • Dark room; limit auditory stimulation

• Common Disorders of the Neurological System

• Neuropathic pain
  • Etiology and pathophysiology
    • May arise from several occurrences
    • The pain transmission is not fully understood
  • Clinical manifestations
• Ranges from mild to excruciating
• Changes in ability to carry out ADLs
  ▪ Medical management/nursing implications
  ▪ Pharmacological management
    ▪ Anticonvulsants; nonopioid analgesics; antidepressants
  ▪ Comfort measures

Common Disorders of the Neurological System

Increased intracranial pressure
  ▪ Etiology/pathophysiology
    ▪ Increase in any content of the cranium
    ▪ Space-occupying lesions, cerebrospinal problems, cerebral edema
  ▪ Clinical manifestations/assessment
    ▪ Diplopia
    ▪ Headache
    ▪ Decreased level of consciousness
    ▪ Pupillary signs

Common Disorders of the Neurological System

Increased intracranial pressure (continued)
  ▪ Clinical manifestations/assessment (continued)
    ▪ Widening pulse pressure
    ▪ Bradycardia
    ▪ Respiratory problems
    ▪ High, uncontrolled temperatures
    ▪ Positive Babinski’s reflex
    ▪ Seizures
    ▪ Posturing
Common Disorders of the Neurological System

Increased intracranial pressure (continued)

  - Medical management/nursing interventions
    - Treat cause if possible
    - Pharmacological management
      - Corticosteroids
      - Antacids; histamine-receptor blockers
      - Anticonvulsants
    - Mechanical decompression
      - Craniotomy
      - Craniecemy
    - Internal monitoring devices

ICP Monitoring:

Disturbances in muscle tone and motor function

  - Etiology/pathophysiology
    - Damage to the nervous system causes serious problems in mobility
  - Clinical manifestations/assessment
    - Flaccid or hyperreflexic muscle tone
    - Clumsiness or incoordination
    - Abnormal gait

Disturbances in muscle tone and motor function (continued)

  - Medical management/nursing interventions
    - Muscle relaxants
• Protect from falls
• Assess skin integrity
• Positioning
• Sit up and tuck chin when eating
• Encourage patient to assist with ADLs
• Emotional support

Other Disorders of the Neurological System

Epilepsy or seizures
  ▪ Etiology/pathophysiology
    • Transitory disturbance in consciousness or in motor, sensory, or autonomic function due to sudden, excessive, and disorderly discharges in the neurons of the brain; results in sudden, violent, involuntary contraction of a group of muscles
    • Types: grand mal; petit mal; psychomotor; Jacksonian-focal; myoclonic; akinetic
    • Status epilepticus

Other Disorders of the Neurological System

Epilepsy or seizures (continued)
  ▪ Clinical manifestations/assessment
    • Depends on type of seizure
    • Aura
    • Postictal period
  ▪ Medical management/nursing interventions
    • During seizure: Protect from aspiration and injury
    • Anticonvulsant medications
    • Surgery
      ▪ Removal of brain tissue where seizure occurs
• Other Disorders of the Neurological System

• Epilepsy or seizures (continued)
  ▪ Medical management/nursing interventions (continued)
    • Adequate rest
    • Good nutrition
    • Avoid alcohol
    • Avoid driving, operating machinery, and swimming until seizures are controlled
    • Good oral hygiene
    • Medic Alert tag

• Degenerative Diseases

• Multiple sclerosis
  ▪ Etiology/pathophysiology
    • Degenerative neurological disorder with demyelination of the brain stem, spinal cord, optic nerves, and cerebrum

• Figure 54-13

• Demyelination:

• Degenerative Diseases

• Multiple sclerosis (continued)
  ▪ Clinical manifestations/assessment
    • Visual problems
    • Urinary incontinence
    • Fatigue
    • Weakness
    • Incoordination
    • Sexual problems
• Swallowing difficulties

Degenerative Diseases

Multiple sclerosis (continued)
  • Medical management/nursing interventions
    • No specific treatment
    • Pharmacological management
      ▪ Adrenocorticotropic hormone (ACTH)
      ▪ Steroids
      ▪ Valium
      ▪ Betaseron (interferon beta-1b)
      ▪ Avonex (interferon beta-1a)
      ▪ Pro-banthine; urecholine
      ▪ Bactrim, Septra, and Macrodantin

Degenerative Diseases

Multiple sclerosis (continued)
  • Medical management/nursing interventions
    • Nutrition
    • Skin care
    • Activity
    • Environmental controls
    • Patient teaching

Degenerative Diseases

Parkinson’s disease
  • Etiology/pathophysiology
    • Deficiency of dopamine
  • Clinical manifestations/assessment
    • Muscular tremors; bradykinesia
    • Rigidity; propulsive gait
    • Emotional instability
- Heat intolerance
- Decreased blinking
- “Pill-rolling” motions of fingers

- Parkinson’s Syndrome

- Figure 54-14

- Degenerative Diseases

- Parkinson’s disease (continued)
  - Medical management/nursing interventions
    - Pharmacological management
      - Levodopa
      - Sinemet
      - Artane
      - Cogentin
      - Symmetrol
  - Surgery
  - Activity
  - Nutrition

- Degenerative Diseases

- Alzheimer’s disease
  - Etiology/pathophysiology
    - Impaired intellectual functioning
    - Chronic, progressive degeneration of the cells of the brain
    - Brain changes include plaques in the cortex, neurofibrillary tangles, and the loss of connections between cells and cell death

- Degenerative Diseases

- Alzheimer’s disease (continued)
  - Clinical manifestations/assessment
• Early stage
  ▪ Mild memory lapses; decreased attention span

• Second stage
  ▪ Obvious memory lapses

• Third stage
  ▪ Total disorientation to person, place, and time
  ▪ Apraxia; wandering

• Terminal stage
  ▪ Severe mental and physical deterioration

Degenerative Diseases

Alzheimer’s disease (continued)
  ▪ Medical management/nursing interventions
    ▪ Pharmacological management
      ▪ Agitation: Lorazepam; Haldol
      ▪ Dementia: Cognex; Aricept
    ▪ Nutrition
      ▪ Finger foods; frequent feedings; encourage fluids
    ▪ Safety
      ▪ Remove burner controls at night
      ▪ Double-lock all doors and windows
      ▪ Constant supervision

Degenerative Diseases

Myasthenia gravis
  ▪ Etiology/pathophysiology
    ▪ Neuromuscular disorder; nerve impulses fail to pass at the myoneural junction; causes muscular weakness
  ▪ Clinical manifestations/assessment
    ▪ Ptosis; diplopia
    ▪ Skeletal weakness; ataxia
    ▪ Dysarthria; dysphagia
    ▪ Bowel and bladder incontinence
Degenerative Diseases

Myasthenia gravis (continued)

- Medical management/nursing interventions
  - Pharmacological management
    - Anticholinesterase drugs
      - Prostigmin
      - Mestinon
    - Corticosteroids
  - May require mechanical ventilation

Degenerative Diseases

Amyotrophic lateral sclerosis (ALS)

- Etiology/pathophysiology
  - Motor neurons in the brain stem and spinal cord gradually degenerate
  - Electrical and chemical messages originating in the brain do not reach the muscles to activate them
  - Lou Gehrig's disease

Degenerative Diseases

Amyotrophic lateral sclerosis (ALS) (continued)

- Clinical manifestations/assessment
  - Weakness of the upper extremities
  - Dysarthria; dysphagia
  - Muscle wasting
  - Compromised respiratory function
- Medical management/nursing interventions
  - No cure
  - Rilutec (Riluzole)
  - Multidisciplinary ALS teams; emotional support
Huntington’s disease

- Etiology/pathophysiology
  - Overactivity of the dopamine pathways
  - Genetically transmitted
- Clinical manifestations/assessment
  - Abnormal and excessive involuntary movements (chorea)
  - Ataxia to immobility
  - Deterioration in mental functions

Degenerative Diseases

Huntington’s disease *(continued)*

- Medical management/nursing interventions
  - No cure; palliative treatment
  - Pharmacological management
    - Antipsychotics
    - Antidepressants
    - Antichoreas
  - Safe environment
  - Emotional support
  - High-calorie diet

Vascular Problems

Stroke (cerebrovascular accident)

- Etiology/pathophysiology
  - Abnormal condition of the blood vessels of the brain: thrombosis; embolism; hemorrhage
  - Results in ischemia of the brain tissue
- Clinical manifestations/assessment
  - Headache
  - Sensory deficit
• Hemiparesis; hemiplegia
• Dysphasia or aphasia

Figure 54-17

Vascular Problems

Stroke (cerebrovascular accident) (continued)

Medical management/nursing interventions

• Thrombosis or embolism
  ▪ Thrombolytics
  ▪ Heparin and Coumadin

• Decadron

• Neurological checks

• Nutritional interventions

• Physical, occupational, and/or speech therapy

Cranial and Peripheral Nerve Disorders

Trigeminal neuralgia

Etiology/pathophysiology

• Degeneration of or pressure on the trigeminal nerve; tic douloureux

Clinical manifestations/assessment

• Excruciating, burning facial pain

Medical management/nursing interventions

• Tegretol

• Surgical resection of the trigeminal nerve

• Avoid stimulation of face on affected side

Cranial and Peripheral Nerve Disorders

Bell’s palsy (peripheral facial paralysis)

Etiology/pathophysiology
• Inflammatory process involving the facial nerve
  ▪ Clinical manifestations/assessment
    • Facial numbness or stiffness
    • Drawing sensation of the face
    • Unilateral weakness of facial muscles
    • Reduction of saliva
    • Pain behind the ear
    • Ringing in ear or other hearing loss

Cranial and Peripheral Nerve Disorders

Bell’s palsy (peripheral facial paralysis) (continued)
  ▪ Medical management/nursing interventions
    • Pharmacological management
      • Corticosteroids
      • Antiviral medications
    • Electrical stimulation
    • Moist heat
    • Massage of the affected area
    • Facial exercises

Cranial and Peripheral Nerve Disorders

Guillain-Barré syndrome
  ▪ Etiology/pathophysiology
    • Inflammation and demyelination of the peripheral nervous system
    • Possibly viral or autoimmune reaction

Cranial and Peripheral Nerve Disorders

Guillain-Barré syndrome (continued)
  ▪ Clinical manifestations/assessment
    • Symptoms are progressive
• Paralysis usually starts in the lower extremities and moves upward; may stop at any point
• Respiratory failure if intercostal muscles are affected
• May have difficulty swallowing, breathing, and speaking

Cranial and Peripheral Nerve Disorders

Guillain-Barré syndrome (continued)
  ▪ Medical management/nursing interventions
    • Adrenocortical steroids
    • Apheresis
    • Mechanical ventilation
    • Gastrostomy tube
    • Meticulous skin care
    • Range-of-motion exercises

Cranial and Peripheral Nerve Disorders

Meningitis
  ▪ Etiology/pathophysiology
    • Acute infection of the meninges
    • Bacterial or aseptic
    • Increased incidence in winter and fall months

Cranial and Peripheral Nerve Disorders

Meningitis (continued)
  ▪ Clinical manifestations/assessment
    • Headache; stiff neck
    • Irritability; restlessness
    • Malaise
    • Nausea and vomiting
• Delirium
• Elevated temperature, pulse, and respirations
• Kernig’s and Brudzinski’s signs

Cranial and Peripheral Nerve Disorders

Meningitis (continued)

Medical management/nursing interventions

Pharmacological management

• Antibiotics
  o Massive doses
  o Multiple types
  o IV or intrathecal
• Corticosteroids
• Anticonvulsants
• Antipyretics

• Dark, quiet room

Cranial and Peripheral Nerve Disorders

Encephalitis

Etiology and pathophysiology

• Acute inflammation of the brain caused by a virus

Clinical manifestations

• Headache
• Fever
• Seizures
• Change in LOC

Medical management and nursing interventions

• Primarily supportive

Cranial and Peripheral Nerve Disorders

West Nile virus
- Etiology and pathophysiology
  - Principal route of infection through the bite of an infected mosquito
- Clinical manifestations
  - Fever
  - Headache
  - Back pain
  - Myalgia
- Prevention

- Cranial and Peripheral Nerve Disorders

- Brain abscess
  - Etiology and pathophysiology
    - Accumulation of pus within the brain tissue
  - Clinical manifestations
    - Headache
    - Fever
    - Drowsiness, changes in LOC
    - Seizures
  - Medical management/nursing interventions
    - Antimicrobial therapy
    - Supportive care

- Cranial and Peripheral Nerve Disorders

- Acquired immunodeficiency syndrome
  - Etiology and pathophysiology
    - Symptoms may develop from the infection with HIV or as a result of an associated infection
  - Clinical manifestations
    - AIDS dementia complex (ADC)
    - Memory loss
• Global cognitive dysfunction
  ■ Medical management/nursing interventions
  • Antiviral, antifungal, antibacterial agents
  • Anticonvulsants
  • Safety

• Cranial and Peripheral Nerve Disorders

• Brain tumors
  ■ Etiology/pathophysiology
  • Benign or malignant
  • Primary or metastatic
  • May affect any area of the brain

• Cranial and Peripheral Nerve Disorders

• Brain tumors (continued)
  ■ Clinical manifestations/assessment
  • Headache
  • Hearing loss
  • Motor weakness
  • Ataxia
  • Decreased alertness and consciousness
  • Abnormal pupil response and/or unequal size
  • Seizures
  • Speech abnormalities

• Cranial and Peripheral Nerve Disorders

• Brain tumors (continued)
  ■ Medical management/nursing interventions
  • Surgical removal of tumor
- Craniotomy
- Intracranial endoscopy

- Radiation
- Chemotherapy
- Combination of above

- Trauma

- Craniocerebral trauma
  - Etiology/pathophysiology
    - Motor vehicle and motorcycle accidents, falls, industrial accidents, assaults, and sports trauma
    - Direct trauma: Head is directly injured
    - Indirect trauma: Tension strains and shearing forces
    - Open head injuries
    - Closed head injuries
    - Hematomas

- Trauma

- Craniocerebral trauma
  - Clinical manifestations/assessment
    - Headache
    - Nausea
    - Vomiting
    - Abnormal sensations
    - Loss of consciousness
    - Bleeding from ears or nose
    - Abnormal pupil size and/or reaction
    - Battle’s sign

- Trauma
• Craniocerebral trauma (continued)
  • Medical management/nursing interventions
    • Maintain airway
    • Oxygen
    • Mannitol and dexamethasone
    • Analgesics
    • Anticonvulsants

• Trauma

• Spinal cord trauma
  • Etiology/pathophysiology
    • Automobile, motorcycle, diving, surfing, other athletic accidents, and gunshot wounds
    • Fracture of vertebra
    • Complete cord injury
    • Incomplete cord injury

• Figure 54-24

• Trauma

• Spinal cord trauma (continued)
  • Clinical manifestations/assessment
    • Loss of muscle function depends on level of injury
    • Spinal shock
    • Autonomic dysreflexia
    • Sexual dysfunction

• Trauma

• Spinal cord trauma (continued)
  • Medical management/nursing interventions
- Realignment of bony column for fractures or dislocations: Immobilization; skeletal traction
  - Surgery for spinal decompression
- Methylprednisolone
- Mobility: Slowly increase sitting up
- Urinary function: Foley catheter; bladder training
  - Intermittent catheterization
- Bowel program

Nursing Process

Nursing diagnoses
- Autonomic dysreflexia
- Communication, impaired
- Coping, compromised family
- Disuse syndrome, risk for
- Grieving
- Infection, risk for
- Knowledge, deficient
- Memory, impaired

Nursing Process

Nursing diagnoses (continued)
- Mobility, impaired physical
- Nutrition, imbalanced: less than body requirements
- Pain, acute, chronic
- Self-care deficit
- Swallowing, impaired
- Thought process, disturbed
- Tissue perfusion (cerebral), ineffective