Neurological Disorders

University of San Francisco
Dr. M. Maag
©2003 Margaret Maag

Class 5 Objectives
Upon completion of this lesson, the student will be able to
- describe how cognitive alterations influence the neurological assessment.
- list the changes in ICP that affect the cerebral perfusion pressure and cerebral oxygenation.
- state common disorders of posture, gait and facial expression.
- differentiate between the types of brain trauma.
- state the etiology and course of the inflammation of the CNS and intracranial hemorrhage.
- write the complications associated with Guillain-Barre and Myasthenia Gravis.
- explain to a classmate the genetic, as well as the environmental factors influencing the neurobiology of schizophrenia and mood disorders.

Acute Coma
- Levels of consciousness diminish in stages:
  - Confusion: can’t think rapidly and clearly
  - Disorientation: begin to lose consciousness
    - Time, place, self
  - Lethargy: spontaneous speech and movement limited
  - Obtundation: arousal (awakeness) is reduced
  - Stupor: deep sleep or unresponsiveness
    - Open eyes to vigorous or repeated stimuli
  - Coma: respond to noxious stimuli only
    - Light (purposeful), full coma (non-purposeful), deep coma (no response)
Clinical Manifestations

- Level of Consciousness (LOC): very critical
- Breathing pattern is irregular (see table 15-4, p. 441)
- Pupillary changes act as a guide for level of brain stem dysfunction (see figure 15-1, p. 442)
- Occulomotor response
  - Occulovestibular (caloric reflex)
  - Motor response: determines level of brain dysfunction and area that is maximally damaged

Seizure

- Etiology: episodes of spontaneous, uncontrolled neurotransmission as seen on an EEG and changes in motor, sensory, or behavioral activity (Hansen, 1998, p. 596)
- Associated conditions: hypoglycemia, infection, tumor, vascular disease, trauma, ETOH/Drug use
  - Be aware that severe seizure may cause hypoxia
  - There may be a report of an “aura” or “prodrome”
Generalized Seizure

- 30% of the seizures
- Stem from the “deep brain”
- Impaired consciousness will always be present
- Examples:
  - Tonic, Clonic, or Clonic-tonic (Grand mal)
  - Absence seizures (Petit mal)
    - Simple vs. complex
- Clinical evaluation tool: EEG

Partial Seizure

- Also termed “focal seizures”
- Rise from the cortex part of the brain
- Simple: no impairment of consciousness
- Complex: with impairment of consciousness
  - 60%

Dementia

- A clinical syndrome that can be caused by various illnesses.
  - It is progressive failure of cerebral functions
    - e.g. mental abilities are affected
      - Orientation, recent memory, remote memory, language, and behavior alterations
  - Etiological factors:
    - Tumors, trauma, infections, vascular disorders
  - http://www.vh.org/adult/provider/neurology/alsheimers/index.html#TOC
Alzheimer’s Disease

- These computer images show the progressive damage to the human brain over a period of 18 months. Areas in the brain that are associated with memory were damaged initially.

Brain Components

- Skull is a rigid vault that does not expand
- It contains 3 volume components:
  - Brain tissue: (80%) or 2% of TBW
  - Intravascular blood: (10%)
  - CSF: (10%)
- Monro-Kellie doctrine: the 3 components are equal within the vault
  - > volume = > intracranial pressure (ICP)

ICP

- Intracranial Pressure (ICP) is the pressure exerted by brain tissue, blood volume & cerebral spinal fluid (CSF) within the skull.
- ICV = Vbrain + Vblood + Vcsf
- CSF is the number 1 displaced content of the cranial vault.
- Cerebral blood flow will be altered if the ICP remains elevated after the displacement of the CSF.
- Vasodilation occurs initially in an attempt to decrease the ICP (compensation for stage 1 of IC hypertension). Once lost…an > ICP.
IICP

Fluid pressure > 15 mm Hg

- IICP is a life threatening situation that results from an increase in any or all 3 components within the skull:
  - > volume of brain tissue, blood, and / or CSF
  - Cerebral edema: > H2O content of tissue as a result of trauma, hemorrhage, tumor, abscess, or ischemia
- Maintain a Semi-Fowlers position
  - Why?

CPP

(Normal = 60 - 100 mm Hg)

- Cerebral Perfusion Pressure (CPP) is responsible for driving nutrients and O2 between cerebral capillary blood & brain cells: “a level of cellular perfusion.”
- Mean Arterial Pressure (MAP) 70-100 mm Hg
  - average arterial pressure during cardiac cycle
  - maintain > 60 mm Hg for perfusion of vital organs
- Intracranial Pressure: (ICP) 0 - 15 mm Hg
- CPP = MAP - ICP (e.g. 90 - 10 = 80)

Clinical Signs and Symptoms

- < LOC: #1 early sign = < awareness of self & environment; dazed; memory lapses; restlessness
  - Brain tissues experience hypoxia and acidosis
- Motor cortex: contralateral hemiparesis
- Behavioral: irrational, hostile, cursing
- Cushing’s Triad: < pulse, widened pulse pressure, and slow deep respirations
- Abnormal reflexes: decorticate, decerebrate, DTR
- Pupil changes: pinpoint = > IICP
Alterations in Motor Function

- Alterations in Muscle Tone
  - Hypotonia: d/t pyramidal tract injury and cerebellar damage
  - Hypertonia: spasticity, dystonia

- Alterations in Movement
  - Hyperkinesia: too much movement
  - Chorea: muscular contractions of extremities or face (random, irregular muscle contractions)
  - Resting tremor: rhythmic movement of a body part
    - e.g. Parkinson’s tremor (“pill rolling”)
  - Akathisia: a hyperactive compulsion to “move around” that brings a sense of peace or relief
    - rt antipsychotic drugs

- Alterations in Movement
  - Paresis: motor function is impaired (weakness)
  - Paralysis: a muscle group can’t overcome gravity
  - Lower motor neuron impairment
    - Ipsilateral findings for the lesion
  - Upper motor neuron paresis or paralysis
    - Contralateral findings
      - Terms used to describe paresis or paralysis
        - Hemiparesis vs. hemiplegia
        - Paraparesis vs. paraplegia
  - Common disorders
    - SCI, Parkinson’s, MS, Tumor, Trauma, Injury at birth

- Alterations in movement
  - Lower motor neuron syndromes
    - Impaired voluntary and involuntary movement
    - Manifestations depend upon location of dysfunction
      - Described as “flaccid” paresis or paralysis
  - Common disorders
    - Polio: viral infection causing paralysis
    - Myasthenia gravis: autoimmune disease that exhibits muscular fatigue and weakness
Brain Trauma

- **Primary brain injury**
  - A direct injury to the brain tissue from an impact
  - Epidural: head strikes a surface
    - e.g. unrestrained MVA (head hits windshield)
    - Epidural hematoma: tearing of an artery from a linear fracture of the temporal bone & blood accumulates between inner skull & dura

- **Subdural**: violent motion of brain tissue in the skull
  - child or elder abuse (violent shaking)
  - Subdural hematoma: tearing of surface vein & blood accumulation in subdural space
    - At Risk: elderly or alcoholics due to falls (poor coordination)
  - "Coup:" impact of head against something
  - "Contrecoup:" impact within the skull (rebound effect)
  - S&S: < LOC, change in respiratory patterns

Brain Trauma

- **Secondary brain injury**
  - Response following primary brain injury
    - As a result of:
      - hypoxia, hypotension, anemia, hypercarbia, cerebral edema, IICP, infection, electrolyte imbalance
      - these insults lead to cellular dysfunction after head injury and can > brain damage and affect functional recovery
CVA

- More common in people > 65 yrs.
- Hemorrhagic: bleeding from a cerebral vessel
  - ruptured aneurysm or bleed into subarachnoid space
  - associated with hypertension, AVM, vessel defects, disorders of anticoagulation, head trauma, DM
- S&S:
  - severe motor & sensory deficits
  - potential cardiac and respiratory arrest
  - severe headache & nuchal rigidity

CVA

- Embolic stroke:
  - d/t fragments that break away from a thrombus formation outside the brain (e.g. common carotid)
  - Embolus obstructs a narrow area of a vessel and causes ischemia
- Cause:
  - atrial fibrillation, MI, endocarditis, RHD, disorders of aorta, carotid, or vertebral-basilar circulation
  - Fat emboli from fractures are a possible cause

Bacterial Meningitis

- An acute or chronic inflammation of the pia mater & arachnoid membranes
  - 20/100,000 annually in neonate population
  - 2 - 9/100,000 annually for > 60 yrs.
  - Mortality is 25% for adults
  - At risk: neurotrauma, congenital malformation, epidemic meningitis
- Bacterial: leukocytosis in CSF via spinal tap
  - Meningococcus and pneumococcus (common)
  - H-flu: 2 mos. to 7 yrs.
  - Pneumococcus or Listeria monocytogens = elderly

Bacterial Meningitis

- An acute or chronic inflammation of the pia mater & arachnoid membranes
  - 20/100,000 annually in neonate population
  - 2 - 9/100,000 annually for > 60 yrs.
  - Mortality is 25% for adults
  - At risk: neurotrauma, congenital malformation, epidemic meningitis
- Bacterial: leukocytosis in CSF via spinal tap
  - Meningococcus and pneumococcus (common)
  - H-flu: 2 mos. to 7 yrs.
  - Pneumococcus or Listeria monocytogens = elderly
Meningitis

- Aseptic: caused primarily by
  - Viruses: echovirus, coxsackievirus, nonparalytic polio, mumps, herpes 1
- Fungal: chronic and less ordinary; associated with immunosuppression
  - Histoplasmosis, candidias, aspergillosis
  - Syphilis, TB, Lyme disease
- TB: is on the rise once again in U.S.
  - headache, low-grade fever, stiff neck, seizures

Clinical Presentations

- Bacterial:
  - Systemic: fever, tachycardia, chills, petechial rash
  - Irritation: general throbbing h/a, photophobia, nuchal rigidity
  - Neurological: cranial nerve damage and irritation
    - CN II: papilledema (> ICP), blindness
    - CN III, IV, VI: ptosis, diplopia, visual field problems
    - CN V: photophobia
    - CN VII: facial paresis
    - CN VIII: deafness, tinnitus, vertigo

Signs of Meningitis

- Brudzinski’s: passive flexion of the neck produces pain & increased rigidity
- Kernig’s: Flex hip and knee and then straighten the knee...pain or resistance?
- Opisthotonos: back & extremities arch backward in a spasm & the body rests on head & heels
**Current Findings**

- **Meningococcal Disease**
  - Risk: crowded living quarters, cold or flu, active or passive tobacco use, deficient immune system, alcohol consumption

- **Meningococcemia**
  - More deadly disease; symptoms mimic flu;
    - Telltale “purple rash”
      - Size of a pinhead or as large as a quarter
      - Medical attention is imperative

- **Future improvement in current vaccine**
  - Conjugate vaccine: sets off a stronger immune response


**Peripheral Nervous System**

- **Guillain-Barré Syndrome**
  - Acquired inflammatory disease involving demyelination of nerves at the periphery
    - Acute onset of motor paralysis
    - 1-2% per 100,000 individuals
    - Preceding events
      - Viral or bacterial infection
      - Campylobacter jejuni...60% of clients

- **Myasthenia Gravis**
  - Chronic autoimmune disease
    - 20-70,000 people in the U.S.
      - d/t antiacetylcholine receptor antibodies
      - Fatigue and weakness that increases with activity
      - > women than men (3:2)
    - Thymus gland involvement: tumors
    - Associated with SLE, RA, thyrotoxicosis
**Major Depression**

- **Etiology:** precise cause is unknown
- **Hypothesis:** A neurochemical deficiency
  - monoamine deficiency (serotonin or norepinephrine)
    - a depressed mood or anhedonia (lack of passion) for at least 2 consecutive weeks and having 3 symptoms
      » change in appetite or weight, change in sleep pattern, agitation, fatigue, feelings of worthlessness or guilt
      » > loss of work...more than other chronic disorders

**Clinical S & S:**
- dysphoria, < activity, <libido, wt. loss or gain, anxiety, pessimism, hopelessness, lack of energy
- **Prevention & Tx:** < risk factors may reduce episodes; antidepressant drugs; regular exercise (> release of endorphins)
  - 60% of suicides d/t depression (18,000/yr. in USA)

**Schizophrenia**

- A gathering of thought disorders
  - Eugene Bleuler (1911)
  - See table 17-1 for symptoms
  - Genetic association
    - Prenatal care
      » Viral infection during pregnancy
      » Dopamine theory
  - Hallucinations, delusions, disorganized behavior and speech
References