

Neurological Disorders

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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 Guillian-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 loose 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)

Glasgow coma scale		
		Score
Eye opening	spontaneously	4
	to speech	3
	to pain	2
	none	1
Verbal response	orientated	5
	confused	4
	inappropriate	3
	incomprehensible	2
	none	1
Motor response	obeys commands	6
	localises to pain	5
	withdraws from pain	4
	flexion to pain	3
	extension to pain	2
	none	1
Maximum score		15

www.studentbmj.com/back_issues/0500/education/140.html

- ### 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)
 - Oculomotor response
 - Oculocephalic (Doll's Head or Doll's Eyes) > intact brain stem
 - Oculovestibular (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
- <http://www.vh.org/adult/patient/neurology/electroencephalogramtest/index.html>

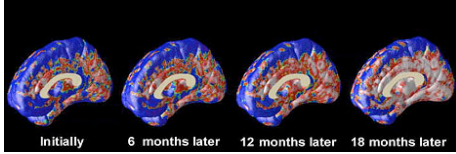
Partial Seizure

- 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/alzheimers/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.
 - New York Times Science, February 11, 2003, p. D6

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.
- $ICV = V_{brain} + V_{blood} + V_{csf}$
- 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.
- Vasoconstriction occurs initially in an attempt to decrease the ICP (compensation for stage 1 of ICP hypertension). Once lost...an > ICP.

IICP

fluid pressure > 15 mm Hg

- IICP is a life threatening situation that results from an \uparrow 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
 - r/t antipsychotic drugs

Alterations in Motor Function

- **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 Motor Function

- **Alterations in movement**
 - **Lower motor neuron syndromes**
 - » Impaired voluntary and involuntary movement
 - » Manifestations depend upon location of dysfunction
 - » Described as "flacid" 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

Brain Trauma

- Primary brain injury-
- **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 d/t 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

Meningitis

- **Aseptic:** caused primarily by
 - Viruses: echovirus, coxsackievirus, nonparalytic polio, mumps, herpes 1
- **Fungal:** chronic and less ordinary; associated with immunosuppression
 - Histoplasmosis, candida, 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
- Meningococemia
 - 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
- <http://www.nytimes.com/2003/02/11/health/11MENI.html?ex=1046023735&ei=1&en=73abb2d0332e82f3>

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

Peripheral Nervous System

- 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 then 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

Major Depression

- **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

- Hansen, M. (1998). *Pathophysiology: Foundations of disease and clinical intervention*. Philadelphia: Saunders.
- Hartshorn, J. C., Sole, M. L., & Lamborn, M. L. (1997). *Introduction to critical care nursing*. Philadelphia: Saunders.
- Huether, S. E., & McCance, K. L. (2002). *Pathophysiology*. St. Louis: Mosby.
