

Module C

Neurological Problems

NUR 203

Structure and Functions of Nervous System

CNS: Brain, Spinal Cord

- **Afferent Pathway** – (*sensory*) Sense & send to CNS

PNS (Peripheral Nervous System): Cranial Nerves, Spinal Nerves

- **Efferent Pathway** – (*motor*) Carry signals away from CNS
 - **Upper Motor Neurons** – located in CNS; destruction causes loss of voluntary control, **muscle spasticity**; and **hyperactive reflexes**.
 - **Lower Motor Neurons** – cranial and spinal efferent neurons lie in gray matter of spinal cord and extend into

Structure and Functions of Nervous System

Continued

- PNS; destruction causes loss of voluntary control, muscle flaccidity, & loss of reflexes.

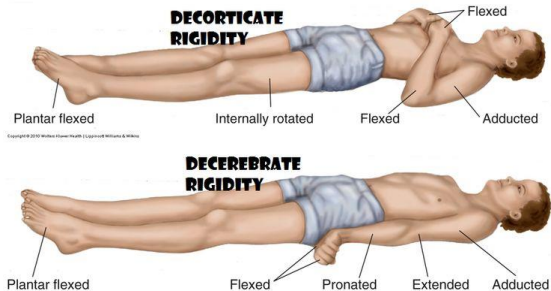
ANS: Includes SNS and PNS

- **SNS** (*Sympathetic Nervous System*) – Norepinephrine; Fight/Flight
- **PNS** (*Parasympathetic Nervous System*) – Acetylcholine; Rest/Digest

Posturing

“Hold the Cat” (CAT in DecortiCATE ~ Flexion)

“Drop the Rat” (RAT in DecerebRATE ~ Extension)



Glasgow Coma Scale

TABLE 38-2

Glasgow Coma Scale

| BEHAVIOR | RESPONSE | SCORE |
|----------------------|-------------------------------------|-----------|
| Eye opening response | Spontaneously | 4 |
| | To speech | 3 |
| | To pain | 2 |
| | No response | 1 |
| Best verbal response | Oriented to time, place, and person | 5 |
| | Confused | 4 |
| | Inappropriate words | 3 |
| | Incomprehensible sounds | 2 |
| | No response | 1 |
| Best motor response | Obeys commands | 6 |
| | Moves to localized pain | 5 |
| | Flexion withdrawal from pain | 4 |
| | Abnormal flexion (decorticate) | 3 |
| | Abnormal extension (decerebrate) | 2 |
| | No response | 1 |
| Total score: | <i>Best response</i> | 15 |
| | <i>Comatose client</i> | 8 or less |
| | <i>Totally unresponsive</i> | 3 |

Δ in GCS – Tell M.D. in 1st 48^o if ↑ or ↓; After 1st 48^o = call if ↓

GCS ↓ 8 = E Tube

Positioning = Neutral, Log Roll, No Flex

↑ **CO₂** = ICP ↑ 40 (4.5) – Keep Alkaline

Cluster Care w/ADL's, etc.; Do not cluster Neuro Checks

Parts of the Brain

Frontal Lobe – controls contraction of skeletal muscles and synchronization of muscular movements; influences abstract thinking, sense of humor, & uniqueness of personality, inhibitions

Parietal Lobe – translates nerve impulses into sensations (*touch, temperature*); interpret sensations; provides appreciation of size, shape, texture, and weight; interprets sense of taste

Temporal Lobe – translate nerve impulses into sensations of sound and interpret sounds (*Wernicke's area*); interpret sense of smell; control behavior patterns.

Occipital Lobe – interprets sense of **vision**

Meninges (*think about a slice of pizza; cranium is the crust*)

- **Dura Matter** – (*tomato sauce*) white fibrous tissue, outer layer
- **Arachnoid** – (*cheese*) “cobwebby” middle layer
- **Pia Matter** – (*pepperoni*) innermost layer; adheres to outer surface of cord and brain; contains blood vessels

CRANIAL NERVES

1



God gave us one nose
(olfactory)

2



God gave us 2 eyes to
see with (optic)

3,4,6



Makes my eyes
do tricks!
(oculomotor,
trochlear,
abducens)

5

TRI

Rhymes with Tri
(for Trigeminal)

7



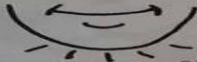
Can fit nicely across
your face to help you
remember the Facial
Cranial nerves

8



Fits nicely into your
ear to assist you to
remember the
acoustic

9, 10



Check gag reflex
Is under my chin.
(glossopharyngeal,
vagus)

11



Put a 1 on each
shoulder and then
shrug them, The 1's
should not fall off
(spinal accessory)

12



For tongue movement
(hypoglossal)

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Seizures and Epilepsy

Seizure – an abnormal, sudden excessive, uncontrolled electrical discharge of neurons within the brain that may result in alteration in consciousness, motor, or sensory ability, and/or behavior.

Epilepsy – chronic disorder characterized by recurrent, unprovoked seizure activity.

Status Epilepticus – prolonged repetitive seizures w/out recovery between attacks; may result in complete exhaustion, cerebral injury, death – **EMERGENCY**

Assessment Tests: EEG – Egghead

- No Caffeine; No Sleeping; Does not have to be NPO; Hair Washed; No Lotion

Types of Seizures

| Generalized | Focal (<i>Partial</i>) | Unknown |
|--|---|---------------------|
| Tonic-Clonic – Tense, Clicking; bowel/bladd Tonic – Tense Clonic – Clicking Absence – Loss of conscious/Most common in kids Myoclonic – Medium clicking; jerking/rigid Atonic – No tone/tension (Loose/Flaccid) | Associated w/automatizms 1) Complex – picking @ shirt, lip smacking, biting; can have brief loss of consciousness 2) Simple 3) 100% Conscious | 50% of all seizures |

Seizure Interventions

During A Seizure

- Safety – stay w/client
- ABC – suction equipment available; put on side

Post Seizure

- LOC; VS; Neuro: Grip; eyes, etc.
- Document: onset; duration; type of seizure; triggers “Aura”

Surgical Management: Vagal nerve stimulation, Conventional surgical procedures

Anticonvulsants

| Tonic-Clonic | Partial | Status Epilepticus | Absence |
|--|---|--|--|
| Hydantoins – phenytoin, fosphenytoin Barbiturates – phenobarbital, primidone (Mysoline) Carboxamides – carbamazepine (Tegretol), oxcarbazepine (Trileptal) | GABA analogs – gabapentin, pregabalin (Lyrica), Lamotrigine (Lamictal), Oxcarbazepine (Trileptal), Levetiracetam (Keppra), Tiagabine (Gabitril), Topiramate (Topamax) | Anticonvulsant & Antianxiety – diazepam, lorazepam PAM & LAM Benzos ASAP | Anticonvulsant & Antianxiety – clonazepam Succinimides – ethosuximide (Zarontin), methsuximide (Celontion) Valproates – valproic acid (Depakene), divalproex sodium (Depakote) |

Major Side Effects of Anticonvulsants

- Dizziness, drowsiness (CNS depression), paresthesia
- Nausea, vomiting
- Skin Rash
- Blood Dyscrasias (decreased RBC's, WBC's, platelet synthesis)
- Hepatotoxicity
- **Phenytoin** – ataxia (neurotoxicity); gingival hyperplasia (gum irritation leading to tissue overgrowth); hirsutism (virilism); hypotension (decreased atrial and ventricular conduction); reddish brown urine; therapeutic serum level is 10 – 20 mcg/mL
 - **Incompatible w/5% dextrose**

Meningitis (Infection)

Patho: Inflammation of the CSF and meninges of the brain and spinal cord.

| Viral | Fungal | Bacterial |
|--|---|--|
| Most Common Occurs after viral illness: measles, mumps, HSV, herpes zoster TX: Acyclovir for genital lesions | Common w/AIDS; can also result from fungal sinusitis TX: antifungals | EMERGENCY Mortality rate 25% Often seen with a predisposing condition: URI, chemo., stress, injury to cranium, OM, Pneumonia, Sickle Cell, immunosuppressed **CLOUDY CSF** |

Symptoms: ALOC, Disoriented, Photophobia, Nystagmus, Abnormal eye movements, H/A's severe, N/V, Signs of ↑ ICP, Fever and Chills, Tachycardia, Red macular rash, Seizures

Meningitis

Lab and Diagnostic Tests

- CSF for cell count, differential, protein, glucose, C&S, and gram stain.
- Blood Cultures
- CIE
- CBC - ↑ WBC, ↑ Protein, ↑ CSF Pressure, ↓ Glucose
- Electrolytes
- **Lumbar Puncture** = Main Test, but also CXR, Sinus/mastoid films, CT, MRI

Meningitis

Interventions

- ABC's
- Neuro Checks q 2 – 4 hours
- Cranial Nerve Assessment
- Vascular Assessment
- I/O to monitor for fluid balance and prevent fluid overload.
- Body weight
- Lab Values
- Positioning
- ROM q 4 hours PRN
- ↓ Environmental Stimuli – including bedrest w/HOB ↑ 30°
- Standard Precautions except for Bacterial which = ISO and Droplet
- **Drugs** – Broad Spectrum ABX, Hyperosmolar agents, Antiepileptic meds, Rifampin, Cipro, or Ceftriaxone

Encephalitis

Patho – Inflammation of the brain tissue and possibly the meninges.

Etiology – Usually from a viral infection

- Arbovirus – transmitted by ticks and mosquitos (West Nile)
- Enteroviruses
- HSV 1
- Amebae

S/S – Fever, ALOC, dysfunction, focal neuro deficits, photophobia, fatigue, signs of ↑ ICP, joint pain, H/A

Interventions – VS, Neuro checks q 2 h, turn and position q 2 h, HOB ↑, ↓ environmental stimuli, TX S/S of ↑ ICP; **DOC** = Acyclovir

Spinal Cord Problems w/CNS

LS Back Pain – most common reason for seeing MD; William's position is most comfortable

Herniated Nucleus Pulposus (HNP) – most common L4-5; can press on nerve; burning in leg or foot; can cause bowel/bladder dysfunction; muscle spasm of affected leg; SX Intervention: Percutaneous Lumbar Diskectomy, Laser Thermodiskectomy, Microdiskectomy, Interbody cage fusion, MIS, Laser-assisted laparoscopic lumbar diskectomy

Post-Op Care – Watch for **Fat Embolism** in spinal fusion = chest pain, dyspnea, anxiety, ALOC, petechiae around neck, upper chest, buccal membrane, and conjunctiva

Spinal Cord Injury

Patho

- **Complete** – spinal cord severed or injured so severely that innervation is eliminated below the level of the injury.
- **Incomplete** – some function or movement remains below the level of injury.
- C-4: controls Respiratory
- T-1: controls Paralysis
- ↓ L1 – L2 = Flaccid “Dilated” Bladder
- ↑ L1 – L2 = Spastic “Constricted” Bladder

Assessment – **M**otor **S**enses

Types of Spinal Cord Injuries

| Hyperflexion | Hyperextension | Axial Loading | Rotation |
|---|--|---|---|
| Head suddenly and forcefully accelerated forward; head on collisions or driving accidents | Head undergoes rapid acceleration and deceleration, tearing or stretching the anterior longitudinal ligament; occurs most often in MVA's when hit from behind or in a fall when the chin is struck | Caused by vertical compression of the spinal column; Vertebrae shatter and fragments enter the spinal cord; occurs in diving accidents, falls on buttocks, landing hard on feet, or blow to top of head | Caused by turning the head beyond the normal range; occurs in MVA's when car is "T-boned" |

Halo Fixation Device: No shower; support head w/small pillows

Spinal Shock Symptoms

Flaccid paralysis, loss of reflex below area of injury, bradycardia, paralytic ileus, urinary retention, hypotension, may last few days to several mos.

Neurogenic Shock

Absence of sympathetic innervation leads to peripheral vasodilation and venous pooling, Hypotension, Bradycardia, and Inability to perspire

S/S: Severe Bradycardia; Warm, dry skin; Severe Hypotension

Intervention: maintain adequate hydration; **DRUGS:** Epi, Dopamine to ↑ BP, Vasopressors, Analgesics, Resp = BAM or SLAM

Autonomic Dysreflexia

EMERGENCY

Patho: Exaggerated autonomic response to factors such as a distended bowel or bladder when lesion is above T6

Etiology: Noxious Stimulus

S/S: sudden onset of severe, throbbing HA, severe, rapidly occurring HTN, bradycardia, flushing above level of lesion (face and chest), pale extremities below level of lesion, nasal stuffiness, sweating, nausea, blurred vision, piloerection (goose bumps), feeling of apprehension

TX: Must be treated quickly to prevent hypertensive stroke. 1st Priority = place in sitting position; call PCP; loosen tight clothing; assess for and TX cause; check urinary cath. tubing for occlusions; if no cath. Check for bladder distention and cath. ASAP if needed; check for fecal impaction; check room temp.; BP q 10 to 15 minutes; Give nitrates or Hydralazine (Apresoline) as prescribed.

Neurological Critically ILL

TIA (Transient Ischemic Attack) (SILENT STROKE) and RIND (Reversible Ischemic Neurologic Deficit) Key Features

- **Visual Deficits** – blurred vision, diplopia (double vision), blindness in one eye, tunnel vision
- **Motor Deficits** – weakness (arm, hand, or leg), gait disturbance (ataxic)
- **Sensory Deficits** – Numbness (face, arm, or hand), vertigo
- **Speech Deficits** – aphasia, dysarthria (slurred speech)

Stroke (Brain Attack)

EMERGENCY

Patho: caused by disruption in blood supply to the brain; autoregulation maintains blood flow at 1 L/min; the brain receives 20% CO; brain cannot store O₂ or glucose; lack of blood flow causes contralateral affects.

Types of Strokes

| Thrombotic | Embolic | Hemorrhagic |
|--------------------|---|--|
| Cause: CLOT | Cause: Emboli from another area in body; Atrial Fibrillation, Ischemic Heart Disease, Rheumatic Fever, MI, Prosthetic valve, MCA is most common site | Bleeding into brain tissue or spaces around brain Cause: ruptured aneurysm |

Stroke (Brain Attack) Continued

Assessment: Remember **FAST**

Face = ask client to smile; does one side of face droop?

Arms = ask client to raise both arms; does one arm drift downward?

Speech = ask client to repeat a simple sentence; does the speech sound slurred or strange?

Time = if any of the signs are observed, call emergency services (911), rapid response team



| Feature | Left Hemisphere | Right Hemisphere |
|-----------------|--|---|
| Language | Aphasia, Agraphia, Alexia | Impaired sense of humor |
| Memory | Possible deficit | Disorientation, inability to recognize faces |
| Vision | Inability to discriminate words or letters, reading problems, deficit right visual field | Visual special deficit, neglect of left visual field, loss of depth perception |
| Behavior | Slow, cautious, anxiety, depression, sense of guilt, feels worthless, worries over future, quick anger or frustration, intellectual impairment | Impulsive, lacks awareness, confabulation, euphoria, constant smiling, denial of illness, poor judgement, overestimation of ability |
| Hearing | None | Unable to hear tonal variations |

****Establish Structure****

| Left Hemisphere Stroke | Right Hemisphere Stroke |
|--|----------------------------------|
| Previously learned motor skills (Apraxia), problems following directions | Sensation, vision proprioception |

Hemiparesis – weakness on one side of the body; **Hemiplegia** – paralysis on one side of body; **Aphasia: Expressive** (motor/Broca) – difficulty making thoughts known to others, speaking and writing most affected; **Receptive** (sensory or Wernicke) – difficulty understanding what others are trying to communicate; interpretation of speech and reading is most affected; **Global** – affects both expression and reception

Improving Cerebral Perfusion

Monitoring for Increased ICP

- **Cushing's Triad** – widening pulse pressure, bradycardia, irregular respirations (possible Cheynne Stokes),
- **Other Signs** - blown pupils or constricted and nonreactive, abnormal posturing, severe HTN, behavior changes, ALOC, aphasia, slurred speech, ataxia
- **Meds & Pt. Education**
 - **Mannitol = Osmotic Diuretic** – monitor for severe dehydration = I/O, BP, sunken eyes, skin turgor

- **Barbiturates** (end in barbital) = Medically Induced Coma = trach vent, monitor Hemo, monitor swan cath.
- **Decadron** = ↓ edema = ↑ BS, H₂O retention, immune compromise

Unilateral Body Neglect

- Most common in clients w/right cerebral stroke
- Inability to recognize physical impairment or lack of proprioception
- Teach to touch and use both sides of body
- Dress affected side first
- With hemianopsia, turn head from side to side

TBI (Traumatic Brain Injury)

Patho: Blow to the head or penetration by foreign object, direct injury, indirect injury

| Open Head Injury (Fractures) | Closed (More Serious) |
|---|---|
| Linear 80% of all skull FX's Depressed Open – lacerated scalp Comminuted – fragments of bone into brain tissue Basilar – base of skull, CSF leak from nose and/or ears , hemorrhage, CN I, II, VII, and VIII damage, infection | ↑ R/F ICP Caused by blunt trauma Contusion Coup – side of impact/ Contrecoup – front/back impact DAI – acceleration/deceleration injury, immediate coma w/poor outcomes Laceration |

Hemorrhage from TBI

Epidural – Arterial (worst); **Subdural** – Venous; **Intracerebral**

ICP & SI ADH and DI

| SI ADH (Kidneys Locked) | DI (No Lock on Kidneys) |
|--|---|
| ↑ADH, ↑ H ₂ O, ↑ ICP = ↑ Dilution, ↓ Na ⁺ ; Kidneys keep H ₂ O in and do not let H ₂ O out. 3% Na ⁺ IV | ↓ ADH, ↑ Output, Renal Failure = Dehydration |

Some Calculations

CPP (> 70 is norm) = MAP – ICP or CVP (whichever is greater)

MAP = $\frac{\text{Diastolic BP} \times 2 + \text{Systolic BP}}{3}$

Normal ICP = 10 – 15

TBI Meds. and Pt. Education

- O₂ = ABC = Suction & Hyper O₂
- Pulse OX
- ABG = 30 – 35
- ICP + VS + Neuro
- NO Flex or bend, NO Supine
- YES Log Roll, C-Spine, Alignment, HOB ↑ 30°

TBI & ICP

| Early Signs | Late Signs |
|--|---|
| <p>Pinpoint Pupils ↑ BP, ↓ HR Ataxia, Uneven Gait GCS > 8 + Rapid, Deep Breathing</p> | <p>Big Blown Pupils ↓ HR, BP 180/40 = Widening Pulse Pressure – Cushing's Triad Decerebrate/Decorticate GCS < 8 Slow Breathing</p> |

Brain Tumors

Supratentorial – located within the cerebral hemispheres = \uparrow HOB 30°

Infratentorial – brainstem and cerebellum = HOB Flat

Meningioma – most common benign tumor, peak at age 50, females affected more than males, tends to recur

S/S – HA, N/V, Visual changes, Seizures, Changes in mentation or personality, Papilledema

NOTE on Reflexes: Oculocephalic (**DOLL's Eyes**) – when head of comatose client is turned to side, eyes should move in opposite direction; absence of reflex suggests brainstem injury; eliciting this response is contraindicated when client has a neck injury.

Huntington's Disease

Patho: An inherited condition in which nerve cells in the brain break down over time.

S/S: Cognitive: amnesia, lack of concentration, memory loss, mental confusion, slowness in activity and thought, or difficulty thinking and understanding; **Muscular:** abnormality walking, increased muscle activity, involuntary movements, problems with coordination, loss of muscle, or muscle spasms; **Behavioral:** compulsive behavior, fidgeting, irritability, or lack of restraint; **Psychological:** delirium, depression, hallucination, or paranoia; **Mood:** anxiety, apathy, or mood swings; **Also common:** tremor, weight loss, or impaired voice