

## TREATMENT & CARE OF THE PATIENT WITH COMPLEX NEUROLOGICAL DISORDERS

### Principles of Increased Intracranial Pressure



---

---

---

---

---

---

---

---

### Monro-Kellie Hypothesis

- ICP is stable as long as volume added is balanced by volume displaced
- Three components inside enclosed skull: brain tissue, blood & CSF
- Expansion by any one causes rise in ICP if volume of other two remains constant

---

---

---

---

---

---

---

---

### Compensator Measures

■ CSF Regulation

■ Pressure Autoregulation

■ Metabolic regulation



---

---

---

---

---

---

---

---

## CSF Regulation

- CSF shunted from brain to spinal subarachnoid space “cisterns”
- Dura can expand and increase absorption

---

---

---

---

---

---

---

---

## Pressure Autoregulation

- Dynamic state of vasoconstriction and vasodilation to maintain consistent cerebral blood flow during changes in systemic arterial pressure
- Cerebral blood flow (CBF) remains constant despite a wide range of mean arterial pressures

---

---

---

---

---

---

---

---

## Metabolic Regulation

- Carbon dioxide is the most potent vasodilator affecting the brain
- Hyperthermia increases use of oxygen and glucose
- High hydrogen concentration

---

---

---

---

---

---

---

---

Cerebral Perfusion Pressure

$$CPP = MAP - ICP$$

CPP: 70 – 100 mm Hg

CPP the driving force that maintains cerebral blood flow

---

---

---

---

---

---

---

---

Calculation of CPP

- $CPP = MAP - ICP$
- $MAP = DBP + 1/3 (SBP - DBP)$  or
- $MAP = \frac{SBP + 2(DBP)}{3}$
  
- Example: B/P 122/84     $MAP = ?$
- $ICP = 12 \text{ mm Hg}$
- $CPP = ? \text{ mm Hg}$

---

---

---

---

---

---

---

---

VENOUS OUTFLOW

- Cerebral veins have no valves, thin walls and little muscle coat
  
- Cerebral veins drain into large venous sinuses
- Susceptible to compression
  
- Increases in intra-abd or thoracic alter venous return

---

---

---

---

---

---

---

---

## ARTERIAL CIRCULATION

- Anterior & posterior circulation function separately
- Connection of anterior and posterior circulation by **communicating arteries**
- **Circle of Willis** can shunt blood from anterior and posterior portions of brain

---

---

---

---

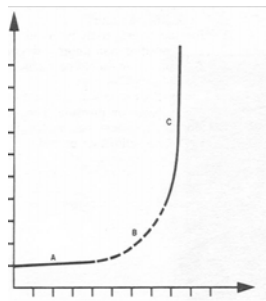
---

---

---

---

## Pressure Volume Curve



- Bottom of graph: units of volume
- Vertical side: ICP
- Point A high compliance
- B - compliance beginning to lessen
- C - lethal increase in ICP

---

---

---

---

---

---

---

---

## Causes of IICP

Increases in

- Total brain volume
- Blood volume
- CSF volume

---

---

---

---

---

---

---

---

**NEUROLOGIC MONITORING  
ASSESSMENT OF LOC**

- Most critical indicator of neurological function
- Full consciousness – deep coma
- Confusion, lethargy, obtundation, stupor, semi coma & comatose
- DESCRIBE level of arousal and cognition rather than use “label”

---

---

---

---

---

---

---

---

**GLASGOW COMA SCALE**

- Best eye opening 1 – 4
- Best motor 1 – 6
- Verbal responses 1 – 5
- Can be inaccurate if patient intubated & no testing of brainstem reflexes
- New FOUR score – eye response, motor response, brainstem reflexes (pupil & corneal) & respiration

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

■ Best eye opening		■ Best motor	
■ Spontaneous	4	■ Obeys commands	6
■ To voice	3	■ Localizes pain	5
■ To pain	2	■ Withdraws	4
■ None	1	■ Flexion	3
		■ Extension	2
		■ None	1
■ Best verbal			
■ Oriented	5		
■ Confused	4		
■ Inappropriate words	3		
■ Incomprehensible sounds	2		
■ None	1		

---

---

---

---

---

---

---

---

■ Unable to arouse pt by verbal stimulation. Noxious stimulus required (nail bed pressure). Incomprehensible sounds when aroused. Withdrawal response to painful stimuli.

■ GCS = 9

---

---

---

---

---

---

---

---

Level of Consciousness

■ RAS

■ Orientation, attention span, language and memory

■ Trapezius mm squeeze, sternal rub & nailbed pressure

---

---

---

---

---

---

---

---

**OTHER CAUSES OF LOC CHANGES?**

List at least six

---

---

---

---

---

---

---

---

**Bedside Neuro Assessment**

- Level of Consciousness
- Pupil Check
- Vital Signs
- Motor Responses & Abnormal Reflexes
- Cranial Nerves
- Sensory Evaluation



---

---

---

---

---

---

---

---

**PERRLA**

- What cranial nerve is responsible for pupil constriction?
- How important would be a change from normal to sluggish or absent pupil response?

---

---

---

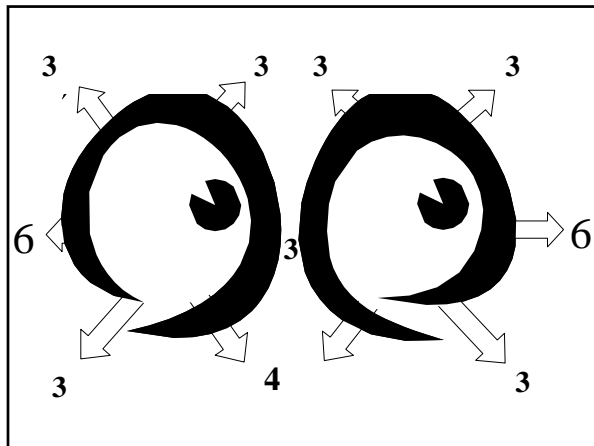
---

---

---

---

---




---

---

---

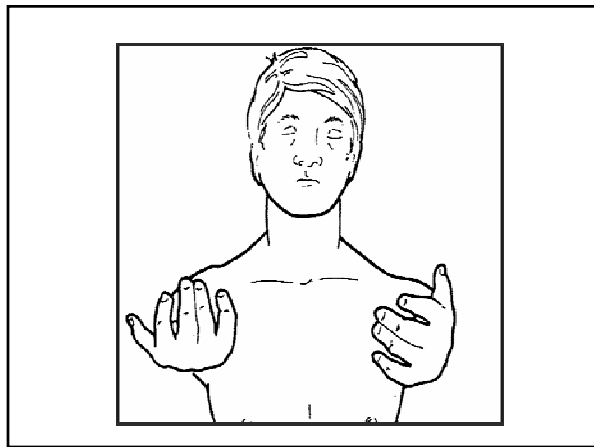
---

---

---

---

---




---

---

---

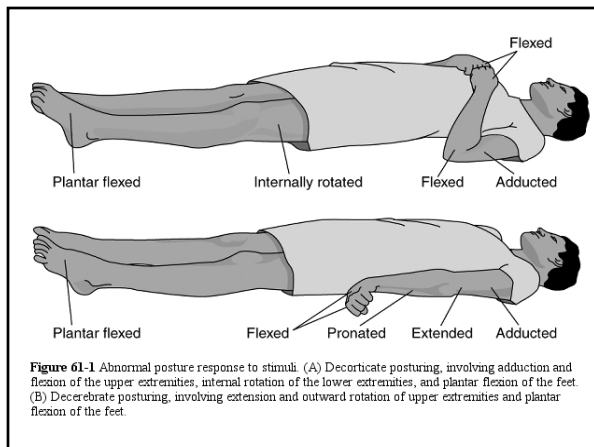
---

---

---

---

---



**Figure 61-1** Abnormal posture response to stimuli. (A) Decorticate posturing, involving adduction and flexion of the upper extremities, internal rotation of the lower extremities, and plantar flexion of the feet. (B) Decerebrate posturing, involving extension and outward rotation of upper extremities and plantar flexion of the feet.

---

---

---

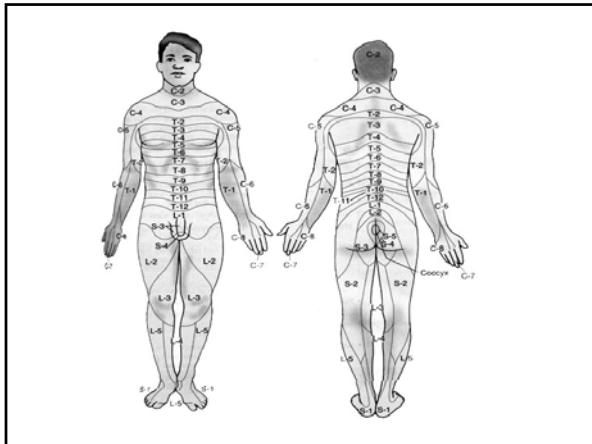
---

---

---

---

---



---

---

---

---

---

---

---

---

### CUSHING REFLEX

- Hypertension with widened pulse pressure
- Bradycardia
- Respiratory Changes

---

---

---

---

---

---

---

---

### HISTORY

- Of the trauma or incident
- Other medical problems

---

---

---

---

---

---

---

---

### Diagnostic Tests

- CT
- MRI
- EEG
- Cerebral Angiography
- Brain Scan
- Lumbar Puncture
- PETT



---

---

---

---

---

---

---

---

### RESPIRATORY & AIRWAY MANAGEMENT

- Suction only as needed; 10 sec
- Pre and post oxygenation
- Lidocaine may help suppress coughing
- Controlled hyperventilation with mechanical ventilation

---

---

---

---

---

---

---

---

### POSITIONING AND MOVEMENT

- HOB elevated
- Neutral alignment
- Prevent Valsalva
- TEDS and sequential air compression

---

---

---

---

---

---

---

---

### F & E ASSESSMENT AND MANAGEMENT

- Fluid restriction
- Avoid hypotonic IV solutions
- Monitor output and specific gravity
- Monitor serum electrolytes (sodium) and osmolality

---

---

---

---

---

---

---

---

### INEFFECTIVE THERMOREGULATION

- Temperature regulation
- Manage elevated temperature
- Maintain normothermia
- Correct use of cooling blanket
- Administer PRN medication



---

---

---

---

---

---

---

---

### ENVIRONMENT AND ICP

- Control environment for noxious stimuli
- Provide undisturbed rest periods
- Avoid clustering nursing activities



---

---

---

---

---

---

---

---

## MEDICATIONS

- Osmotic diuresis – mannitol (Osmitol)
- Antiseizure – phenytoin (Dilantin)
- Proton pump inhibitor  
pantoprazole (Protonix)
- Antipyretics
- Analgesics



---

---

---

---

---

---

---

---

## % SOLUTION MATH - MED

- % = \_\_\_ GRAMS PER 100 mL
- Mannitol 25% = 25 g/100 mL
- Doctor's Order:  
Give Mannitol 50 g IV
- Give \_\_\_ mL



---

---

---

---

---

---

---

---

## IICP TREATMENTS

- Body position in alignment
- Temperature control
- Seizure prevention
- Adequate oxygenation
- Osmotic diuretics
- Sedation
- Surgical intervention for hematoma
- Drainage of CSF

---

---

---

---

---

---

---

---

Subsequent Treatments for Refractory IICP

- Hyperventilation to decrease pCO<sub>2</sub>
- Barbiturate coma (pentobarbital sodium)
- Propofol (Diprivan) shorter ½ life
- Decompressive craniectomy

---

---

---

---

---

---

---

---

BRAIN DEATH CRITERIA

- **Apnea most important brain stem sign**
- No evidence cerebral hemisphere function or brainstem function for extended period
- Absent pupillary, extraocular, corneal, gag and cough reflexes (brainstem )
- Not a result of CNS depressant drug, alcohol, hypothermia (<32 degrees C or 90 F)
- Absence of cerebral blood flow

---

---

---

---

---

---

---

---

New England Organ Bank  
800-446-6362 when  
death imminent

---

---

---

---

---

---

---

---

### CAUTION - DANGER

- Similar Trade Names – Use Generic Name
- Celebrex – celecoxib - NSAID
- Celexa – citalopram – SSRI
- Cerebyx – fosphenytoin - anticonvulsant

---

---

---

---

---

---

---

---

### NUSING (NANDA) DIAGNOSES

- Decreased intracranial adaptive capacity
- Ineffective tissue perfusion, cerebral
- Ineffective breathing pattern
- Risk for disuse syndrome
- Disturbed thought processes
- Interrupted family process

---

---

---

---

---

---

---

---

### PLANNING NOC LABELS

- Neurological status: Consciousness
- Tissue perfusion, cerebral
- Respiratory status: Ventilation
- Immobility consequences:  
Physiological
- Distorted thought control
- Family coping

---

---

---

---

---

---

---

---

## NIC INTERVENTIONS

- Monitor neurologic status, ICP monitoring
- Airway management
- Exercise therapy: joint mobility
- Delusion management
- Environmental management

---

---

---

---

---

---

---

---

### LECTURE OBJECTIVES

- Apply knowledge of pathophysiology to the clinical manifestations of increasing intracranial pressure (ICP)
- Prioritize assessments of the critically ill patient with neurologic problems using Maslow's hierarchy of needs
- Distinguish early and late manifestations of increasing ICP
- Differentiate the common types of traumatic brain injury (TBI)
- Describe the psychosocial and behavioral manifestations associated with TBI

---

---

---

---

---

---

---

---

- Explain the risk factors and complications of TBI in the older adult
- Determine the diagnostic tests used for the neurologic patient
- Specific at least four NANDA diagnoses, NIC-based interventions & NOC-based outcomes for the critically ill patient with neurologic problems
- Describe the motor & sensory assessments for the patient with acute spinal cord injury (SCI)
- Formulate a nursing plan of care for the medical complications that can be experienced by patients with SCI
- Distinguish the immediate post injury and chronic complication of SCI
- Evaluate the risk factors that contribute to back pain

---

---

---

---

---

---

---

---