












- 1  **Traumatic Brain Injury**
Regina Ketts, RN, MSN, CCRN, CCNS
Clinical Nurse Specialist
OU Medical Center
- 2  **Objectives**
 - ▶ List primary traumatic brain injuries.
 - ▶ Discuss the relationship between intracranial pressure, cerebral perfusion pressure, and cerebral blood flow.
 - ▶ Identify interventions to manage intracranial hypertension.
 - ▶ Outline measures to try to prevent secondary brain injuries.
- 3  **Definitions**
 - ▶ Head injury:
 - Any injury of scalp, skull, or brain
 - ▶ Traumatic Brain Injury
 - Injury from trauma that causes tissue disruption
- 4  **Classification of Head Injuries**
 - ▶ Mild
 - GCS 13 - 15
 - 80%
 - ▶ Moderate
 - GCS 9 - 12
 - 10%
 - ▶ Severe
 - GCS \leq 8
 - 10%
 - (10% die prior to hospitalization)
- 5  **Traumatic Brain Injuries by Etiology, 2004 – 2005**
(<http://ips.health.ok.gov>)
 - 2 ▶ Total of 8,781 residents suffered TBI
 - ▶ Falls and MVCs were leading causes of all TBI
 - ▶ Gunshot wounds and MVCs were leading causes of TBI preadmission deaths
- 6  **TBI Case-Fatality Rates by Age Group**
 - ▶ Total of 1, 927 deaths from a TBI in 2004 – 2005
 - ▶ Persons 45 – 54 years had the highest fatality rate, while children under 15 years had the lowest
 - ▶ Males had a higher case-fatality rate than females (25% compared to 17%)
- 7  **TBI Survivors by Hospital Discharge Status**
 - ▶ Of the 8,781 persons who suffered a TBI, 78% survived.
 - ▶ Majority of TBI survivors were discharged home after their hospital stay
 - ▶ 10% of survivors went to inpatient rehabilitation facility upon discharge
 - ▶ 12% of survivors were discharged to a skilled nursing facility or nursing home
- 8  **Fall-Related TBI by Age Group 65 Years and Older 2005**
 - ▶ Majority of fall-related injuries occurred among persons between the ages of 75 and 89 years.
 - ▶ 58% of patients were female
 - ▶ Median age for males was 79 years and for females was 82 years
 - ▶ 86% of pts. had one or more of the following conditions documented in the record
 - Skull fracture
 - Intracranial lesion
 - Amnesia
 - Decreased LOC


- Neurological/neuropsychological abnormalities
- ▶ 53% of pts. had abnormal imaging results that were likely due to the TBI
- 9 **Question #1 – Motorcycle Crash Injury Laws (www.health.state.ok.us)**
 - ▶ States with “no law” regarding helmets have lower fatality rates than “law” states
 - ▶ Helmets obstruct peripheral vision
 - ▶ Helmets interfere with critical hearing
 - ▶ Motorcyclists are just hurting themselves and should be left alone
- True or False?
- 10 **Phases of Prevention and Care – First phase**
 - ▶ Use of protective equipment
 - Lap belts reduce mortality from TBI by 50% (MVC)
 - Helmets reduce mortality from TBI by 50% (MCC)
 - Helmets reduce mortality from TBI by 85% (bicycle)
 - ▶ Legislative controls
 - ATV legislation
 - ▶ Knowledge and use of safety behaviors related to hazards
 - ▶ Knowledge and use of environmental modifications
 - ▶ Avoiding substance use
 - ▶ Flat screen TVs
- 11 **Second Phase**
 - ▶ Emergency medical services
 - ▶ Prevention of secondary injuries
 - Trauma System
 - ▶ Prevention of further brain injuries
 - ▶ Prevention of secondary conditions/disabilities
- 12 **Third Phase**
 - ▶ Inpatient services
 - ▶ Prevention of further Impairment, Disability, or Handicap
 - Optimize overall health status
 - Assess functional status periodically to intervene medically as needed
 - Maintain maximum functional independence given injury severity, overall health status, and pre-injury level of function
- 13 **Fourth and Fifth Phase**
 - ▶ Fourth
 - Inpatient rehabilitation
 - ▶
 - ▶ Fifth
 - Services available in the community
 - Outpatient rehabilitation
 - Vocational rehab and employment counseling
 - Independent living assistance
- 14 **TBI Case Study**
 - ▶ 36 y/o male in motorcycle crash
 - Traveling approximately 50 mph
 - Ran into the back of a pick-up
 - ▶ Found lying supine in center lane of highway
 - ▶ Not wearing a helmet and minimal braking noted
 - ▶ EMS report
 - Unresponsive, snoring respirations, bleeding from right ear, obvious skull fracture, abrasions to left face, GSC of 3
 - ▶ IVs started and pt. bagged during transport

- 15  **Case study – Admit to ER**
- ▶ Primary survey completed
 - ▶ Secondary survey completed, routine lab, X-rays, and CT scans
 - ▶ Lines/tubes inserted
 - RSI
 - Right subclavian central line
 - Left radial arterial line
 - Foley
 - OG tube
 - ▶ VS on admission
 - BP = 216/99
 - HR = 87
 - RR = 22
 - Temp. = 37.3
 - GCS = 3 – 4 prior to intubation
 - ▶ FAST exam negative

- 16  **Case study – Injury list**
- ▶ Lateral temporal bone fracture
 - ▶ Bilateral mastoid fractures
 - ▶ Bilateral frontal subarachnoid and subdural hemorrhages
 - ▶ Intraparenchymal hemorrhage of the brain stem and mid brain
 - ▶ Neurosurgery consult obtained
 - Ventriculostomy performed and ventricular catheter inserted into the right ventricle

- 17  **Mechanism of Injury**
- ▶ Acceleration
 - Head is stationary, hit with movable object
 - Assaults, falling objects
 -
 - Deceleration
 - Head is moving, hits stationary object
 - MVAs, falls
 -
 -
 -
 -

18 

- 19  **Mechanism of Injury**
- ▶ Coup Injury
 - Impact against object
 - Impact
 - Shearing of subdural veins
 - Trauma to base
 - ▶ Contracoup injury
 - Hitting opposite side
 - Impact
 - Shearing throughout brain

20 

- 21  **Diagnosis**
- ▶ Computerized Tomography (CT scan)
 - Computerized reconstruction of series of thin slices of brain

- Emitter-detector pairs cover 180° circle surrounding head
- Tissues have differing radiodensities
- ▶ Advantages
 - Testing speed
 - Excellent detail and resolution

22  **Computed Tomography**

- ▶ Terms to look for on report:
 - Contusion
 - Depressed segment
 - Intraparenchymal blood
 - Blood in ventricles
 - Mass effect
 - Cisterns
 - Midline shift
 - Edema
 - Herniation
 - Gray/white differentiation

23  **Primary Injuries**

- ▶ Fractures
 - Simple - bone not displaced
 - Depressed - inward depression of outer table of skull
 - Basilar - base of skull
 - Based on clinical presentation
 -
 -

24 

25 

26  **Interventions for CSF Leaks**

- ▶ Keep HOB elevated
- ▶ Nothing in nose or ears
- ▶ Instruct not to blow nose
- ▶ Apply loose dressing over ear or nose
- ▶ Prevent Valsalva maneuver or vigorous coughing
- ▶ Maintain lumbar drain at ordered level

27 

28 

29 

30 

31  **Diffuse Axonal Injury**

- ▶ Shearing; stretching and tearing of axons
- ▶ Severe widespread damage of white matter
- ▶ Clinical findings:
 - Deep & prolonged coma
 - Initial decortication or decerebration
 - Increased ICP
 - Elevated temperature


32 

33 

34  **Open or Penetrating Injuries**

- ▶ Open fractures

- ▶
- ▶ Penetrating trauma
 - Puncture wounds
 - Stab wounds
 - Firearm wounds

35  **Question #2 – GSW to Head**


- ▶ You are preparing to admit a pt. who has a GSW to the head.
- ▶ Which entry wound locations are considered most lethal:
 - A. Placed at the temple
 - B. Placed under the chin pointed straight up
 - C. Placed inside the mouth pointed posteriorly
 - D. Placed behind one of the ears

36  **Penetrating Trauma**

- ▶ Factors affecting extent of bullet wounds damage
 - Bullet caliber
 - Type of bullet
 - Type of gun – velocity
 - Trajectory of bullet
 - Range of fire

37  **Tissue Injury from Missiles**


- ▶ Direct
 - Laceration
 - Heat of the bullet
 - Combustion of gases
- ▶ Indirect
 - Cavitation
 - Creates path by pushing tissue away
 - Shock waves

38  **Secondary Injuries - Systemic**

- 1 ▶ Hypotension
 - ▶
 - ▶ Hypoxia
 - ▶
 - ▶ Hyperthermia
 - ▶
 - ▶ Hypercapnia
 - ▶
- 2 ▶ Electrolyte imbalances
 - ▶ Hyperglycemia
 - ▶ Acid-base abnormalities
 - ▶ Systemic inflammatory abnormalities

39  **Question #3 : Hypotension Management**

- ▶ Patient's BP decreases to 70/40
- ▶ In which position do you want to place the patient while initiating interventions to treat the hypotension?
 - A. Flat
 - B. HOB up 30 degrees
 - C. Reverse trendelenburg
 - D. Trendelenburg

40  **Secondary Injuries - Intracranial**

- 1 ▶ Intracranial hypertension

- ▶ Mass lesions
- ▶ Cerebral edema
- ▶ Vasospasm
- ▶ Hydrocephalus
- ▶ Infection
- 2 ▶ Seizure
- ▶ Regional and global ischemia
- ▶ Metabolic derangements
- ▶ Transmembrane ion imbalances
- ▶ Free-radical induced membrane damage

41

42 **Intracranial Hypertension**

- ▶ Intracranial Pressure (ICP)
 - Normal: ICP less than 15
- ▶ Clinical signs
 - Change in LOC, motor activity, pupils, cranial nerves, or VS
 - Increasing headache
 - Visual changes
 - Seizure activity
 - Vomiting

▶

▶

43

Question # 4: Increased ICP

- ▶ After being in the ICU 2 hours, the pts. ICPs are 24 – 28. The EVD is open to drain. In preparing to contact the NES, what additional information will you need to obtain?

44

Question # 4

- ▶ MAP
- ▶ CVP
- ▶ Clinical neuro exam if possible
- ▶ ABG results
- ▶ Current dosages of analgesics and sedatives
- ▶ EVD output
- ▶ Fever
- ▶ Relevant history and previous medical management

45








Cerebral Perfusion Pressure

- ▶ $CPP = MAP - ICP$
- ▶ Normal: 80 - 100 mm Hg (range 60 - 150)
- ▶ CPP below 50 causes vasodilatory response in arteries
- ▶ CPP 60 – 70 needed to prevent vasodilatory response
- ▶ CPP above 70 produces vasoconstriction
- ▶ CPP less than 30 mm Hg. not compatible with survival
- ▶ Maintenance of cerebral perfusion is critical.

46

Cerebral Blood Flow

- ▶ Brain receives 15% of total CO
- ▶ $CBF \sim 50 \text{ ml}/100 \text{ g}$ brain tissue per minute
- ▶ Determined by systemic arterial pressure; venous return pressure; vessel diameter; and blood viscosity
- ▶ Autoregulation
 - Pressure: changes in diameter of cerebral vessels
 - CBF maintained over range of MAPs (50 – 160 mm Hg)

- Metabolic: vasodilation due to ischemia, hypoxia, hypercapnia
- 47  **CBF - Ischemia**
 - ▶ CBF decreases during first 4 - 6 hrs. post injury by 50 - 60%
 - ▶ Gradually increases over next 36 - 48 hrs. but remains 20 - 30% below normal
 - ▶ Cerebral metabolism increases first several hours and decreases over several days
 - ▶ Increase metabolism and decreased flow can lead to ischemia
- 48  **CBF - Hyperemia**
 - ▶ CBF in excess of metabolic demand
 - Due to loss of autoregulation
 - Vascular engorgement, swelling, & edema
 - ▶ Least reactive/most dilated vessels within the infarcted area
 - Causes inverse steal of blood
 - Uninjured tissue becomes hypoxic
- 49  **Cerebral Metabolism**
 - ▶ Brain accounts for 20% of total body oxygen consumption/25% systemic glucose at rest
 - ▶ O₂ delivery is product of arterial oxygen content, Hg, and CBF
 - ▶ Factors affecting oxygen delivery
 - CBF: hypotension, increased ICP, hypercapnea, vasospasm
 - Oxygen carrying capacity: anemia, pulmonary problems
 - ▶ Decrease in oxygen delivery without reduction in metabolism leads to more functional loss
- 50  **Secondary Brain Injury Pathophysiology**
 - 1 ▶ Primary brain injury
 - ▶ Inflammatory response triggered by damaged cells
 - ▶ Vasogenic edema
 - ▶ Cerebral ischemia and impaired autoregulation
 - 2 ▶ Decreased ATP production
 - ▶ Increased lactic acidosis
 - ▶ Increased intraacellular influx of sodium, chloride, calcium, and water
 - ▶ Cytotoxic Edema
- 51  **Vasogenic Edema**
 - ▶ Most common type of cerebral edema
 - ▶ Water and protein accumulate in interstitium
 - ▶ Alteration in the blood-brain barrier
 - ▶ Occurs mainly within white matter
 - ▶ Leads to increased ICP
- 52  **Cytogenic Edema**
 - ▶ Fluid accumulates in intracellular spaces
 - ▶ Sodium-potassium pump fails
 - ▶ Results in swelling of neurons, glial cells, and endothelial cells
 - ▶ Usually affects gray matter
 - ▶ Leads to neuronal dysfunction
- 53  **Indications for ICP Monitoring**
 - ▶ Potentially salvageable pts. with severe head injury (GCS 3 – 8 after resuscitation) with an abnormal admission head CT scan
 - Hematomas, contusions, swelling, herniation, or compressed basal cisterns
 - ▶ Severe head injury (GCS 3- 8) with a normal CT scan if or more of the following are present
 - a. Age >40

- b. Unilateral or bilateral motor posturing
- c. SBP < 90 mm Hg

54  **ICP Monitoring Techniques**

- 1 ▶ 2 Basic systems
 -
 - Fluid-filled (hydraulic)
 -
 - Fiberoptics
- 2 ▶ Types by location
 - Subarachnoid
 -
 - Ventricular
 -
 - Intraparenchymal
 -
 - Epidural

55 

56  **Subarachnoid "Bolt"**

- 1 ▶ Advantages
 - Quick insertion
 - No penetration of brain
 - Decreased risk of infection
 - No repositioning of transducer
- 2 ▶ Disadvantages
 - Unable to drain CSF
 - Fair waveform
 - Unreliable when debris (brain, dura, clot) herniates into device
 - Usually require own monitoring device
 - Catheter dislodgement

57 

58  **Ventriculostomy**

- 1 ▶ Advantages
 - "Gold standard"
 - Reflects whole brain pressure
 - Allows CSF drainage
 - Good waveform
 - Reliable measurement
- 2 ▶ Disadvantages
 - Most difficult to insert
 - Small ventricles or shift
 - May occlude
 - Risk of infection
 - Need transducer repositioning
 - Needs close monitoring of CSF drainage

59  **Question # 5 – Troubleshooting a Ventricular Drain**

- ▶ Your patient's ventricular drain has no waveform and has had no drainage of CSF in the last 2 hours. Which of the following troubleshooting interventions do you want to take initially?
 - A. Check all tubing and stopcocks
 - B. Flush the catheter with 5 ml of preservative-free normal saline

- C. Lower the drainage chamber to zero or below the patient's head and observe for drip of CSF fluid
- D. Notify the neurosurgeon
- E. Continue to monitor output for another hour

60

61

62

Question # 6 – ICP waveform

▶ What change in the ICP waveform morphology may indicate impending intracranial hypertension?

- A. P1 peaked
- B. P2 elevation
- C. P3 not visible
- D. Waveform mimics A-line waveform

63

ICP Waveform Interpretation

▶ Dampened waveforms

- Occluded; improperly placed; air in cranium or transducer; craniectomy

▶ P₂ elevation

- Decreased compliance
- Increased risk for elevated ICP during care – related activities

▶ Increased pulse amplitude

- Cerebral vasodilation

▶ ICP waveform looks like arterial waveform

- Loss of autoregulation

64

65

Cerebral Oxygenation Monitoring Techniques

▶ Jugular bulb oxygen saturation (S_jO₂)

- Global measuring device
- Fiberoptic catheter placed in jugular vein
- Normal value: 60 – 75%

▶ Regional – type monitors (*Licox*)

▶ Measures oxygen status and brain temperature within brain tissue itself

- Normal PbtO₂ 25 – 30 mm Hg

66

Guidelines for Management of Severe Traumatic Brain Injury

1

▶ General Maneuvers

- HOB Elevation
- Oxygenation/ ventilation
- Normothermia
- Volume resuscitation
- Sedation
- Paralytics

2

▶ "First-line" Therapies

- CSF drainage
- Moderate hypocapnia
- Mannitol
- Hypertonic saline

67

Question #7 – Rapid Sequence Intubation

▶ All of the following medications may be used for RSI except:

- A. Oxygen
- B. Lidocaine


- C. Etomidate or versed
- D. Succinylcholine or rocuronium
- E. Pavulon
- F. Fentanyl or morphine

68  **Goals of Therapy**

- ▶ Prevent hypotension
 - SBP >90
 -
- ▶ Prevent hypoxia and hypercapnia
 - pO₂ at least 60
 - O₂ sat > 90%
 - pCO₂ ≥ 35

69  **Goals of Therapy**

- ▶ Prevent further neurologic damage
 - Maintain ICP <20
 - CPP 50 - 70 mm Hg.
 - Maintain serum glucose 80 - 150
 - Keep normothermic
 - Keep normovolemic

70  **Question #8: ABG Results**

- ▶ Current ventilator settings are: SIMV 40%; 600; 10; 5 PEEP. ABG results are pH = 7.32; pCO₂ = 50; pO₂ = 120; SaO₂ = 98%; HCO₃ = 25. Are these blood gases acceptable? If not, what ventilator changes are indicated?
 - A. Increase the PEEP
 - B. Increase the rate
 - C. Decrease the FIO₂
 - D. Decrease the tidal volume

71  **Hyperventilation**









- ▶ Shifts oxyhemoglobin dissociation curve to left
 - Increased affinity of Hg to oxygen
 - Decreased availability of oxygen to brain
- ▶ Inverse steal phenomenon
 - Blood shunted from uninjured areas due to vasoconstriction
 - Blood is "squeezed" into injured areas










72  **Pulmonary Care**

- ▶ PEEP
 - To improve oxygenation
 - PEEP above 10 may decrease CO and CPP
- ▶ Suctioning
 - Always increases ICP
 - Hyperoxygenate and hyperventilate
 - Limit to 2 passes of catheter
 - Prophylactic lidocaine administration to reduce tracheal stimulation


73  **Positioning**

- ▶ HOB elevated to 30 degrees
- ▶ CPP may be better with HOB flat
- ▶ Maintain head in neutral position
- ▶ Avoid tight cervical collars and ET tape
- ▶ Flex at hips not abdomen

- 74  **Osmotherapy**
- ▶ Mannitol
 - Maximum osmotic effect within 20 - 40 min.
 - Can reduce ICP by 30% in 60 minutes
 - Induces hemodilution and decreases blood viscosity
 - Reestablishes blood flow through microcirculation
 - Enhances oxygen delivery to injured regions
- 75  **Hypertonic Solutions**
- ▶ Increases osmotic pressure
 - Draws fluids into vascular space from ECF compartments
 - ▶ Proposed to decrease cerebral edema and increase CBF
 - ▶ No information available as to survival or neurologic recovery rates
 - ▶ Used to raise serum sodium
 - Maintain Na around 140
- 76  **Question # 9: Rate of Mannitol Administration**
- ▶ Which of the following are recommended administration rates for Mannitol?
 - A. Intermittent bolus infused within 15 minutes
 - B. Intermittent bolus infused over 1 hour
 - C. Continuous infusion over 4 hours
 - D. IV push as quickly as possible
- 77  **Fluid Management**
- ▶ Maintain euvolemic state
 - CVP 5 to 8 mm Hg
 - PCWP 8 to 12 mm Hg
 - Serum osmolality <310 mmol/kg H₂O
 - Consider losses
 - Avoid glucose solutions
- 78  **Diabetes Insipidus**
- ▶ Deficiency in ADH
 - ▶ Injury to hypothalamus or pituitary
 - ▶ Increased serum osmo & sodium
 - ▶ Low urine specific gravity
 - ▶ UO greater than 200 cc/hr for 2 consecutive hours
- 79  **DI Treatment**
- ▶ Desmopressin acetate (DDAVP)
 - 1 - 4 mcg. IV q 8 - 12 hrs
 - ▶
 - ▶ Replace fluid losses
 - ▶ Vasopressin infusions
- 80  **SIADH**
- ▶ Abnormally high levels of ADH with normal intravascular volume
 - ▶
 - ▶ Decreased serum osmo & sodium
 - ▶
 - ▶ Increased urine sodium & osmo
 - ▶
 - ▶ Concentrated low urine output
- 81  **Treatment of SIADH**
- ▶ Fluid restriction to 800 - 1000 ml/day

- ▶
- ▶ Severe (Na <120) - 3% hypertonic saline and diuretics
- 82  **Cerebral Salt Wasting**
 - ▶ Increased effect of ANF
 - ▶ Low serum osmo & sodium
 - ▶ Concentrated, low urine output
 - ▶ Hypovolemic/dehydrated
 - ▶
 - ▶ Treatment:
 - Replace volume - IVFs of NS or 3% hypertonic saline
 - Enteral salt
- 83  **Pain/Sedation Management**
 - 1  ▶ Administer analgesics
 - ▶
 - Assess for nonverbal indications of pain
 - Morphine and Fentanyl most commonly used
 - Try to avoid hypotension
 - 2  ▶ Administer sedatives
 - ▶
 - Control agitation
 - Benzodiazepines commonly used
 - Continuous infusions may be necessary
 - Try to avoid hypotension
- 84  **Propofol (Diprivan)**
 - ▶ Sedative/hypnotic
 - Causes EEG depression
 - Decreases cerebral metabolic demand
 - Decreases CPP, CBF, and ICP without increase in lactate levels and with adequate cerebral oxygenation
 - Short - acting, allows neuro exams
- 85  **Ventriculostomy**
 - ▶ Drain CSF as ordered
 - ▶ Assess and maintain patency of drainage system
 - ▶ Avoid inadvertent drainage of excess CSF
 - ▶ Maintain height of drainage system as ordered
 - ▶ Use meticulous technique when handling the system (dressing/tubing changes)
- 86 
- 87  **"Second-tier" Therapies**
 - ▶ High-dose barbiturates
 - ▶ Other options
 - Severe hyperventilation
 - $pCO_2 < 30$
 - Hypertensive management
 - Mild or moderate hypothermia
 - Decompressive craniectomy
- 88  **Pentobarbital Coma**
 - ▶ 1) Loading dose: 3 - 10 mg/kg over 30 minutes to 3 hours
 - ▶ 2) Maintenance: 0.5 to 3 mg/kg/hr
 - ▶ 3) Adjustments:
 - Pentobarb levels: 20 - 40 mg/dL.

- ICP less than 25
- Burst suppression on EEG
- BIS Monitoring

89  **Question # 9: Pentobarbital**

▶ When administering the loading dose of pentobarbital, which physiologic parameter is the most important to monitor?

- A. ICP
- B. Heart rate
- C. Blood Pressure
- D. Urine output

90  **Burst Suppression**

▶ Bursts of EEG activity alternating with isoelectric (flat or suppressed) EEG


91  **Pentobarbital**

1 ▶ Advantages

- Reduces cerebral metabolism
- Reduces responsiveness to external stimuli
- Stabilizes cerebral blood flow

2 ▶ Disadvantages

- Decreases SVR and depresses myocardium
- Causes hypotension
- Increases incidence of pneumonia and infection
- Limits neuro exams

92  **Surgical Interventions**

Craniectomy – removal of bone flap

Factors considered: age; severity of brain injury; severity of other injuries

Immediate/prophylactic: acute evacuation of hematoma with massive cerebral swelling

Delayed/therapeutic: within 48 hrs. from onset uncontrolled intracranial HTN

Not responding to medical therapy

Reimplantation: 3 – 6 months

Safety considerations

93  **Other Nursing Care Priorities**

▶ Temperature Control

▶ Increases metabolic rate 10 - 13% per degree C.

- Start treating at 37.5
- Tylenol routinely
- Cooling blanket, fan, baths, ice packs
- Intracranial temp. may be 0.5 - 2.0 C. higher than body temp.

◦

▶

▶

◦

94  **Question # 11: Positioning**

▶ To prevent complications associated with immobility such as VAP; pressure ulcers; and DVTs in a patient with episodes of intracranial hypertension, all of the following position changes are preferable except:

- A. HOB elevated 45 degrees and not turned
- B. 20 degree tilt from side to side
- C. Turned at least once a shift for skin assessment
- D. Attempt repositioning every 2 hours and communicate positions with acceptable ICPs

95 

Seizure Prophylaxis

- ▶ Seizure may cause secondary brain damage
 - Increases cerebral metabolic demands
 - Raises ICP
 - Results in excess release of neurotransmitters
- ▶ Prophylaxis is effective in reducing early seizures
 - First 7 days
- ▶ May not have an effect on late seizures or have an effect on death or neurological disability

96 Nutrition

- ▶ Early enteral nutrition preferably within hrs. post-trauma
- ▶ Verify feeding tube placement frequently
- ▶ H₂ Blockers
 - To prevent stress ulcers
- ▶ HOB elevated at least 30 degrees
 - To avoid aspiration
- ▶ Stool softeners and laxatives
 - To avoid Valsalva

97 Nursing Care and Intracranial Pressure Monitoring (AJCC Patient Care Page, July 2009)

- ▶ Understand the effect of nursing care on ICP
- ▶ Determine ICP reference ranges for each pt. as determined by physician orders, underlying pathology, and POC
- ▶ Monitor pulmonary hygiene and the effects of interventions
- ▶ Determine a daily interdisciplinary POC
- ▶ Initiate nursing consults for skin management and hygiene
- ▶ Plan nursing care at intervals to allow pts. with elevated ICP to stabilize
- ▶ Maintain HOB elevation based on patient's underlying disease process

98 Summary of Medical management of ICP

- 1 ▶ HOB elevation to 30°
 - ▶ Avoidance of venous outflow impediments
 - ▶ Appropriate analgesia
 - ▶ Sedation with or without paralytics

- 2 Maintenance of PaCO₂ 30 - 35

- ▶ Normothermia
- ▶ Hyperosmolar euvolemia
- ▶ CSF drainage via ventriculostomy
- ▶ Normoglycemia
- ▶ CPP between 50-70
- ▶ Maintenance of P_{bt} O₂ 15 – 20 torr

99 Questions 12 & 13: Families

- ▶ You overhear the pt's mother explaining to another family member that the pt. will not wake up until we turn off the medications. How would you clarify this statement to the family?
- ▶ Family members of the pt. frequently ask the nurse "Are they going to be alright?" How would you address prognosis or long term implications of a severe TBI?

100 Family Support

- ▶ Assess family - identify spokesperson
- ▶ Provide frequent explanations
- ▶ Provide consistent information

- ▶ Preserve family unit
- ▶ Recognize family members are also victims

101 

102 

103 

Clinical Signs of Brain Death

- ▶ Total unresponsiveness to environment
- ▶ Absence of spontaneous movement
- ▶ Absence of reflexes
 - Pupils fixed and dilated
 - Doll's eyes absent (oculocephalic)
 - Oculovestibular reflex absent (cold caloric)
 - No cough, gag, or corneal

104 

105 

Clinical signs cont'd

- ▶ No facial movements
- ▶ Absence of breathing
 - Apnea tests
- ▶
 - ▶ Confirmatory diagnostic tests
 - Cerebral perfusion scan

106 

TICU Wall of Fame

The "Good"

107 

Turning a Negative into a Positive

108 

Not what we hoped for

- ▶ Severe disability
- ▶ Persistent vegetative state

109 

Thank you!

- ▶ Questions?