CHILD WITH A NEUROLOGICAL CONDITION

Linnard-Palmer & Coats
Chapter 27
https://www.youtube.com/watch?v=HxGXP8JIfm4
https://www.youtube.com/watch?v=bbGSI0Ahtac

https://www.youtube.com/watch?v=8q4L8b8s6mo

Learning Outcomes

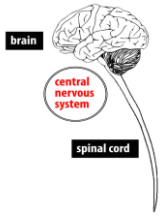
- Describe the development and function of the nervous system
- Assessment of the neurological system
- Define and discuss various:
  - Congenital neurological disorders (cerebral palsy);
  - Neurological injuries (drowning/near drowning, lead poisoning, meningitis, Reye's syndrome, traumatic brain injury);
  - Other neurological disorders (brain tumors, cognitive impairment, febrile seizures, and infantile seizures)

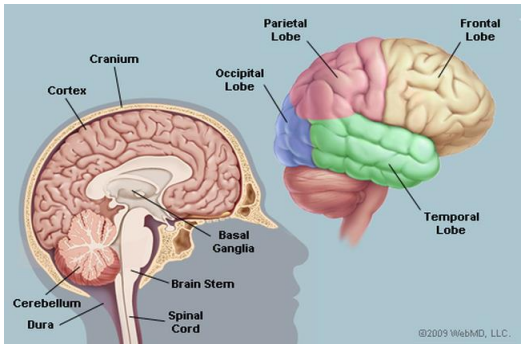
Development and function of nervous system

- Two main components
  - Central
  - Peripheral
- Begins during embryonic and intrauterine period

Central Nervous System

- Central Nervous System
  - Brain; cerebrum; frontal, temporal, parietal, and occipital lobes
  - Spinal cord

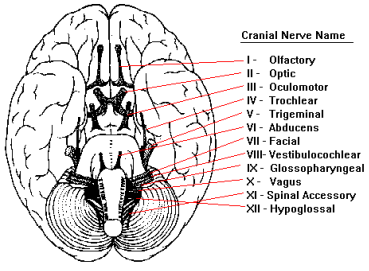




Peripheral Nervous System

- 12 pairs of cranial nerves
- 31 pairs of spinal nerves
- Afferent neurons (body to brain)
- Efferent neurons (brain to body)

Cranial Nerves



ANS/SNS

- Autonomic Nervous System
  - Regulated by hypothalamus
  - Responsible for involuntary body functions
- Sympathetic Nervous System
  - Emergency responses
  - "Fight or flight"

Brain

- Coordinates entire nervous system
- Myelination
- Three protective membranes (meninges)
  - Dura mater arachnoid membrane pia mater
- Cerebrospinal fluid circulates in the subarachnoid space
  - Excess absorbed by membrane
- Open cranial sutures/fontanels compensate for increases in intracranial pressure (ICP)
  - Ability of sutures to open and fontanels to bulge stops
  - ICP balance is then maintained by
    - _____
    - _____
    - _____

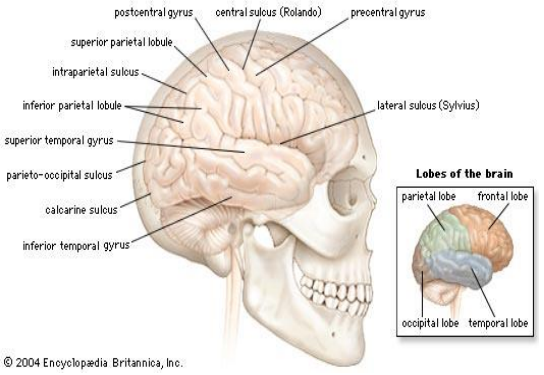
Increased aldosterone = increased sodium/water retention = increased BP

Neurological Assessment

- Health history
  - Risk factors for neurological injury
  - Risk factors associated with perinatal period
  - Family history
- Physical examination
  - Rapid visual assessment
  - Further inspection; breathing, LOC (confusion?, obtunded?), abnormal movements
  - Vital signs
  - Fixed, dilated pupils
  - Brainstem herniation; opisthotonos, poor PERRLA, bradycardia, increased bp

Opisthotonos

- Backward arching of the head, neck, and spine



Rapid Neurological Assessment

- LOC, ability to respond
- Memory
- Ability to speak, swallow
- Strength in hands, legs
- Incontinence
- Balance, coordination, gait
- Fontanels
- Reflexes

Assess Reflexes

- Moro's Reflex
  - Normal reflex for an infant when he or she is scared or feels like they are falling. The arms will fling out sideways with the palms up and the thumbs flexed.
- Sucking
- Startle
  - Movement when exposed to a loud sound
- Fencing/Tonic Neck
- Dancing/Step

Reflexes

Moro's Reflex

Fencing/Tonic Neck

Labs/Diagnostics

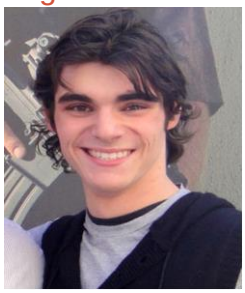
- Labs
  - Electrolytes
  - Complete Blood Count (CBC)
  - Serum lead level
  - Blood culture
- Diagnostic tests
  - Lumbar puncture
  - Electroencephalogram (EEG)
  - Urinalysis

Common Medications

- Anticonvulsants
  - Gabapentin (Neurontin)
  - Clonazepam (Klonopin)
- Diuretics
  - Mannitol (Osmitrol)
  - Furosemide (Lasix)
- Neuromuscular blockers
  - Pancuronium (Pavulon)
  - Rocuronium (Zemuron)
- CNS stimulants
  - Methylphenidate (Concerta, Ritalin)
  - Dextroamphetamine (Adderall)

Congenital Neurological Disorders

- Cerebral Palsy



- https://www.youtube.com/watch?v=Cc-cbcJVw00

Cerebral Palsy

- Group of disorders affecting nervous system and brain
- Non-progressive, related to anoxia
  - Before, during, or after birth, up until 2nd year
- Can result in:
  - Failure to meet **developmental milestones**
  - Abnormal perception and sensation
  - Speech, hearing, vision impairments
  - Seizures
  - Cognitive disability
- Degree of severity differs
  - Mild to severe

Types of CP

- Spastic CP (pyramidal)
  - Hypertonicity/ poor posture control/ leg scissoring/ altered speech/ impaired fine and gross motor skills
- Dyskinetic CP (nonspastic, extrapyramidal)
  - Athetoid- involuntary jerking movements involving the extremities, trunk, neck, and face (writhing and wormlike)
  - Dystonic- slow, twisting movements of the trunk or extremities. Muscles of the pharynx, larynx, oral regions involved
- Ataxic CP (nonspastic, extrapyramidal)
  - Poor muscle coordination, equilibrium
  - Unsteady gait

Nursing Interventions

- Assess developmental level
- Maintain airway
- Symptom management
  - Skin care
  - Promote mobility
- Parental support/education
- Medications
  - Baclofen (oral, intrathecal pump)
  - Diazepam (oral, rectal, IV, IM)
  - Botulinum toxin (injection)
  - Antiepileptics/Anticonvulsants

Neurological Injuries

- Drowning and Near Drowning
- Lead Poisoning
- Meningitis
- Reye's Syndrome
- Traumatic Brain Injury

Drowning and Near Drowning

- Submersion in a liquid medium followed by suffocation and asphyxia
- Drowning
  - Child dies within 24 hours after submersion
- Near drowning
  - Child lives beyond 24 hours, recovers or dies
- Peak periods
  - Preschool
  - Later adolescence (15-19)
- Close to 80% of childhood near drowning victims survive
  - Rapid CPR

Assessment

- Airway
- Ventilation ability
- Quality of respirations
- Heart rate
- Blood pressure
- ABGs
- LOC/neuro checks

Interventions

- Rapid resuscitation
- Ventilator support
- Restore effective cardiac rhythm
- Correction of shock
  - Altered mental status
  - Cool extremities
  - Slow cap-refill
- IV fluid
- Family support

Lead Poisoning

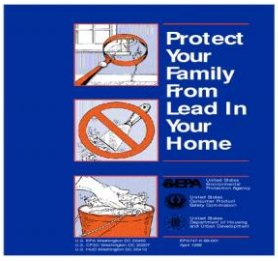
- Heavy, soft, gray-blue metal substance
  - Commercially used substance
  - Can be naturally occurring
- Considered highly toxic
  - Binds to proteins (sulfhydryl), irreversibly impairing brain function
- Particularly harmful to children, leads to;
  - Encephalopathy-brain dysfunction of varying degrees
  - Poor school performance
  - Lower intelligence

Lead Poisoning

- Children exposed to lead through:
  - Contaminated soil
  - Contaminated clothing
  - Lead-based paint
  - Imported candy, jewelry, pottery
- #1 lead exposure source for American children
  - Lead-contaminated household dust from paint (hand to mouth)
- Serum lead levels (pg. 490)
  - $\geq$ 10 Considered lead poisoned
  - 20+ Remove from environment
  - $\geq$ 70 Emergency hospitalization
  - Textbook: Medical interventions/treatment when child is symptomatic or when blood lead levels above 45

Assessment

- Thorough assessment of environmental history
  - Year the home was built
  - Type of paint used
- Child's age
  - Teething behavior
  - Pica behavior
- Symptoms of LP:
  - Metallic taste in mouth
  - GI upset
  - Decreased UOP
  - Altered mentation
  - Personality change
  - Black-blue discoloration



Interventions

- Assess for changes in normal behavior
- Mild cases
  - Safe environment, **education**
  - Symptomatic?
- Higher levels- hospitalization/medications
- Chelation therapy (remove heavy metals from blood)
  - Dimercaprol (BAL)- painful IM injection
    assess for peanut allergy
  - Edetate calcium-disodium (EDTA)- IV or IM
    IV route may cause increased ICP-cerebral edema
    do not give with known kidney problems, low BP, or low UOP
- Check discharge policies

Meningitis

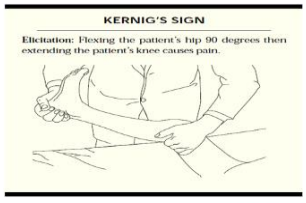
- Inflammation of the membranes of the brain or spinal cord
- Bacteria, virus, or chemical enters bloodstream
- Pathogen causes;
  - Severe inflammation of the meninges
  - Possible cerebral edema
- Spreads by mucus during coughing, sneezing
- Enters body through:
  - Nasal cavity
  - Middle ear
  - Neurosurgery
  - Trauma

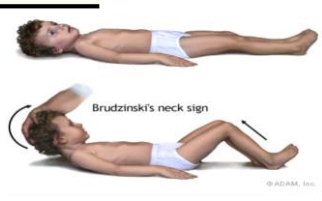
Meningitis

- More common in infants and toddlers
- Viral Meningitis
  - Supportive care, duration 6-10 days
- Bacterial (meningococcal – most severe type) Meningitis
  - Caused by *Neisseria meningitidis*
  - Sudden, severe infection leading to DIC
  - Massive hemorrhages
  - Purpura
  - High mortality rate
  - Rapid identification/antibiotic administration needed
  - Bacterial meningitis also caused by; *Streptococcus pneumoniae* (pneumococcal), *Haemophilus influenzae* type B (Hib), and *Escherichia coli*

Expected Findings

- Assessment symptoms:
  - Poor feeding habits
  - Fever, headache, nausea
  - Irritability, high pitched cry, inconsolable
  - Lethargy
  - Bulging fontanels
  - Opisthotonos positioning
  - Kernig's sign
  - Brudzinski's sign





Diagnostics/Interventions

- **Isolation**
- Urinalysis, CBC, blood culture
- CSF analysis
  - **Viral**: clear; slightly elevated WBC; normal to slightly elevated protein; normal to elevated glucose content; negative gram stain
  - **Bacterial**: cloudy; elevated WBC; elevated protein; decreased glucose content; positive gram stain
- Antibiotics
  - Must match causative organism
- Corticosteroids
  - Prevent/manage cerebral edema/increased ICP (bacterial)
  - Dexamethasone
- Anticonvulsants

Interventions

- Isolation
- Monitor VS, urine output, fluid status, neurologic status
- Newborns/infants
  - Monitor head circumference
  - Fontanels
- Correct fluid balance, restrict fluids
- NPO if decreased LOC
- Decrease environmental stimuli
  - Quiet environment
  - No bright lights
  - Cool environment
- Keep family informed

Reye's Syndrome

- Non-inflammatory encephalopathy causing swelling in the brain and liver
  - Can also involve spleen, pancreas, kidney, and lymph
- Rare cases result in death
  - Brain tissue herniation, cerebral edema, sepsis, shock
- Cause not known
  - Associated with use of salicylates to treat symptoms of viral infections
  - Also occurs without the use of salicylates
  - Syndrome typically follows a viral illness
    - Influenza, gastroenteritis, varicella

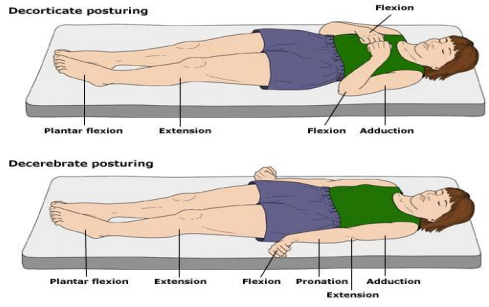
Reye's Assessment

- Early symptoms
  - Irritability, diarrhea, tachypnea
- With progression:
  - Encephalopathy
  - Increased ICP
  - Metabolic dysfunction
  - Hepatic dysfunction
  - Renal damage
  - Fatty infiltration

Stages of Reye's Syndrome

- Stage I
  - Lethargy, vomiting, sleepiness, normal posture, brisk pupil reaction, purposeful response to painful stimuli
- Stage II (5-7 days after Stage I)
  - Combative, stuporous and disoriented, normal posture, sluggish pupil reaction, purposeful/non-purposeful response to pain
- Stage III
  - Coma, decorticate posture, sluggish pupil reaction
- Stage IV
  - Coma, seizures, decerebrate posture, sluggish pupil reaction
- Stage V
  - Coma, apnea, limpness, no pupil reaction

Posturing



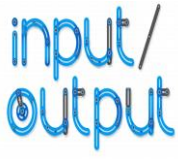
Labs/Diagnostics

- Liver enzymes ALT, AST
  - _____
- Serum ammonia
  - _____
- Electrolytes
  - Altered
- Coagulation times
  - May be extended
- Liver biopsy
- CSF analysis
  - To rule-out _____

Interventions

- Monitor for progression through stages
- Monitor neuro status
  - LOC, confusion, deficits
  - Initial GCS score
- Hydration with a source of glucose
- Assess for increasing ICP
- Monitor for seizure, precautions
- Monitor respiratory status
- HOB 30-45 degrees
- Quiet environment
- Free of discomfort, prevent crying

MONITOR



Pediatric Modification of the Glasgow Coma Scale

Eye Opening	
1 year 4 Spontaneously 3 To verbal command 2 To pain 1 No response	**0–1 year** 4 Spontaneously 3 To shout 2 To pain 1 No response
Best Motor Response	
>1 year 6 Obeys 5 Localizes pain 4 Flexion withdrawal 3 Flexion abnormal (decorticate) 2 Extension (decerebrate) 1 No response	**0–1 year** 6 Normal spontaneous movements 5 Localizes pain 4 Flexion withdrawal 3 Flexion abnormal (decorticate) 2 Extension (decerebrate) 1 No response

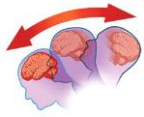
Best Verbal Behavior		
0–2 years 5 Coos, babbles 4 Irritable 3 Cries to pain 2 Moans to pain 1 None	**2–5 years** 5 Appropriate words 4 Inappropriate words 3 Cries/screams 2 Nonspecific sounds 1 None	**5 years** 5 Oriented, converses 4 Disoriented 3 Inappropriate words 2 Incomprehensible sounds 1 No response

Scoring:
- 13–15: Mild head injury
- 9–12: Moderate head injury
- <8: Severe head injury; intubation may be required

https://www.youtube.com/watch?v=uwrNh5LkdgU

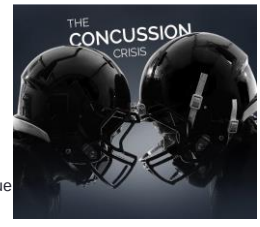
Traumatic Brain Injury (TBI)

- Head injuries
  - 5% fatal
  - 20% lead to long-term disability
  - Severe outcomes related to cerebral edema and increased ICP
- Primary
  - Develop at the time of trauma
  - Brain suffers initial damage
- Secondary
  - Develops as the child's body responds to injury
  - Can develop days or hours after the injury
  - Irreversible consequences if not treated



Types of TBI

- Concussion
  - Shearing/compression of brain's nerve tissue
  - May have a transient loss of consciousness
  - Injury can be wide-spread
  - Post-concussion syndrome
- Contusion
  - Bruising of brain tissue
  - Associated with blunt trauma
  - Tears vasculature and/or tissue
  - Localized



Findings

- Minor injury
  - Possible loss of consciousness, period of confusion
  - Initial assessment must begin with determining LOC
  - Vomiting, pallor, irritability, lethargy, drowsiness
- Progression of injury
  - Changes in LOC-**early sign of progression**
  - Marked changes in VS
  - Altered mental status
  - Neurologic deficits
- Severe injury
  - Infants: bulging fontanel, separation of cranial sutures, irritable, increased sleeping, high pitched cry, setting-sun sign, distended scalp veins

Findings

- Severe injury
  - Initial assessment must begin with determining LOC
  - Children: nausea, headache, forceful vomiting, blurred vision, increased sleeping, unable to follow simple commands, decline in school performance, seizures
  - Late Signs: altered pupil response, posturing, bradycardia, decreased motor response, decreased response to pain, Cheyne-stokes respirations, decreased consciousness, coma

Assessment

- Airway patency
- VS
- Neuro checks
  - Signs of shock
  - Poor perfusion
  - Increased ICP
- Cushing's Triad
  - Late sign of ICP
  - Widening pulse pressure, irregular breathing, bradycardia
- Monitor LOC
  - GCS ≤ 8 = significantly poorer outcomes, disability

When a child with a head injury experiences a change or progression of symptoms……
It must be reported immediately!!

Labs/Diagnostics

- ABGs
- Blood alcohol/toxicology
- CBC with differential, Liver function
- Cervical spine X-ray
- CT and/or MRI head and neck
- Measurement of ICP
  - Expected range 1-10 mmHg

Interventions

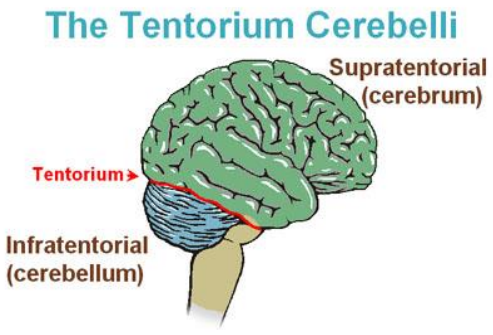
- Airway management is top priority
- PICU or pediatric unit?
- Low stimulation environment
  - Rest, sedation
- Be mindful of post-traumatic hyperthermia
  - Manage core temp
- HOB raised to help decrease ICP
- Monitor ICP if required
- Medications
- Parents

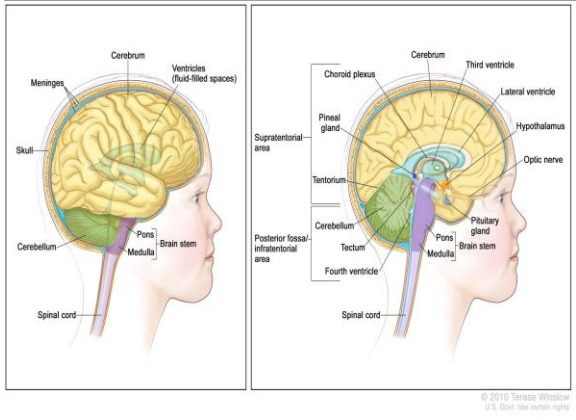
Neurological Disorders

- Brain Tumors
- Cognitive Impairment
- Febrile Seizures
- Infantile Seizures

Brain Tumors

- Most common solid malignancy during childhood
- Classified by
  - Location
  - Grade (low grade, high grade)
- Cerebellar astrocytoma
  - Most common childhood subtentorial tumor
  - 5-year survival rate 90%
- Medulloblastoma
  - Most prevalent tumor in children < 7





Assessment

- Child will typically present with:
  - Signs and symptoms of ICP
  - Focal neurological signs
- Often demonstrate behavior/personality alterations in the weeks before the tumor is identified

- Interventions:
  - Depend on size and location, age of child
  - Surgery, irradiation, chemotherapy
  - Complications of growing tumor: ICP, compression, hydrocephalus, brainstem herniation, neg. effects of radiation (endocrine, intellectual, motor deficits)

Nursing Considerations

- Family support
- Cancer diagnosis causes:
  - Fear, anxiety, sadness
- Provide information regarding
  - Diagnosis, treatment, follow-up care, long-term prognosis
  - Repeat as necessary
- Nursing care
  - Assess changes in presentation pre- and post-op
  - Carefully follow orders
  - Report signs of increased ICP
- Post-op clinical presentation may worsen following surgery
  - Should improve as cerebral edema decreases

Cognitive Impairment

- Term has replaced *mental retardation*
- Considered a disability
- Limitations that developed in;
  - Social, conceptual, and adaptive skills
- Mild: IQ 50-55 and up to 70
  - Most prevalent
- Moderate: IQ 35-40 and up to 50-55
  - Most Down's syndrome children
- Severe: IQ of 20-25 and up to 35-40
  - Complete custodial care
- Profound: IQ below 20-25
  - Requires complete care

Assessment

- Focus on developmental status
- Assess ability to perform motor and psychological tasks
- Determination of functioning/limitation performed over time

Interventions

- Ensure child is safe
- Assist family with support of basic needs
- Set realistic goals and break into tasks
- Acknowledge goal achievement

Nursing Considerations

- With suspected CI, assess for;
  - Toxic exposures
  - Environmental hazards
  - Genetic disorders
  - Chronic conditions
- Encourage activity in support organizations
  - Special Olympics
  - American Association on Intellectual and Developmental Disabilities
  - County-run developmental centers

Seizure Disorders

- Seizure
  - Disruption of electrical communication in the child's brain
  - Symptom of an underlying CNS injury/disorder
  - Manifestations; loss of consciousness, abnormal movements, behavioral abnormalities, sensory disturbances
- Recurrent seizures
- Seizure disorder
  - Child experiences seizure two or more times in 24 hrs.
- Common pediatric causes;
  - Trauma, hemorrhage, brain malformations, genetic disorders, brain dysmaturity, infection, fever, electrolyte imbalance, metabolic issues, drug-related injury/exposure, CNS lesions

Seizure types- Febrile Seizures

- Description
  - Generalized seizure, rapid rise in core body temp.
  - Rarely seen before 9 mos., after age 5
  - Most common seizure during childhood
  - Spontaneously remit without therapy
  - Incidence 2-5%
- Characteristics
  - Often follows bacterial/viral infection
  - Last <5 minutes
  - Considered harmless for most (**not** a seizure disorder)
- Treatment/Prevention
  - Find source of rise in temp., treat infection
  - With history of febrile seizure, **administer antipyretics at first sign of infection**

Seizure types- Infantile Spasms

- Description
  - Generalized seizure between 3 and 12 months of age
  - Peak 4-8 months
- Characteristics
  - Sudden stiffening, jerking
  - *Jackknife seizures*
  - May lose some motor skills
- Treatment
  - Anticonvulsants
  - Steroids

Interventions

- Safety precautions
  - Pad side rails
  - Assess need for safety devices
  - Supervision
  - Suction and oxygen available
- During seizure
  - Do not try to stop/control
  - Do not place anything in the mouth
  - Remove objects that could cause harm
  - If child is lying, place on side if possible
- Anticonvulsant therapy
  - Strict adherence
  - Education to family

Question….

- The nurse is caring for a child who has been in a motor vehicle accident (MVA). The child falls asleep unless her name is called or she is gently shaken. This state of consciousness is referred to as:
  - 1) Coma.
  - 2) Delirium.
  - 3) Obtunded.
  - 4) Confusion.

Answer

Question….

- Which signs best indicate increased intracranial pressure (ICP) in an infant? **Select all that apply.**
  - 1) Sunken anterior fontanel.
  - 2) Complaints of blurred vision.
  - 3) High-pitched cry.
  - 4) Increased appetite.
  - 5) Sleeping more than ususal.

Answer

Question….

- The nurse is caring for a 6-month-old-infant diagnosed with meningitis. When the child is placed in the supine position and flexes his neck, the nurse notes he flexes his knees and hips. This is referred to as:
  - 1) Brudzinski sign.
  - 2) Cushing triad.
  - 3) Kernig sign.
  - 4) Nuchal rigidity.

Answer

Question….

Answer

Question….

Answer

Question….

Order: Mannitol- Give 1.5 g over 60 minutes.

Supply: 2g/100mL

Drug Book Recommends: 1-2 g/kg over 30-60 minutes.

What would you set the IV pump to run at per hour? (round to one decimal place).

Answer…..

1.5 g/2 g X 100 mL = 75 mL

The End……