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NAPNAP Acute Care Review Course

Neurology
Sedation/ Analgesia

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Objectives

1. Identify neurologic presentations, findings and significant disease processes.
2. Recognize critical neurologic changes in infants and children and recommended treatment strategies.
3. Determine diagnosis and treatment of acute care neurologic disease process and common diagnostic modalities utilized.

Neurology

- Seizures
- Spinal Cord Injury
- Traumatic Brain Injury
- Cerebral Palsy
- Encephalopathy
- Hydrocephalus
- Altered Mental Status and other neurologic problems

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Seizures

Seizures: Abnormal electrical discharge in the brain with an associated altered level of consciousness and rhythmic movements followed by a post-ictal state.

- **Associated Symptoms:** incontinence of bowel and bladder, apnea, cyanosis. May be preceded by an aura.
- **Common causes:** fever, ingestion, electrolyte disturbance, infections or tumor.

Seizure History

- Most important aspect of diagnosis is **detailed history** of event, type of seizure and resulting disability
- Family history of seizures? Travel History or sick contacts?
- **Labs**: CBC, electrolytes (glucose, calcium sodium and magnesium), drug levels and toxicology screen.
- **ED:** lasts >5 minutes, head injury, high fever, compromised resp or cardiac function.

Types of Seizures

Generalized **Atonic** **Focal**	Bilateral hemispheres are engaged Sudden loss of tone Originates in one hemisphere
Clonic **Tonic**	Rhythmic repetitive movements Sustained extension or flexion of head trunk or extremities
Febrile	Occur on rise of fever, usually between ages 6-60 months, generalized, last less than 15 minutes and do not recur within 24hrs. No testing or neuroimaging necessary unless meningeal signs.

Status Epilepticus

Status Epilepticus	A single seizure lasting longer than 30 minutes or two or more consecutive seizures without returning to baseline LOC. Referral to the ED		First line therapy -ABC, then benzodiazepines PR, IM, IV. Secondary therapy with AED's. Dilantin, Keppra or phenobarbital load. Refractory-may require drug induced coma-EEG for burst suppression or surgical resection. Vagal nerve stimulator may be implanted.

Seizure Control

- Stabilize-0-5 min, ABC's, IV, critical labs, drug levels
- Initial Therapy- 5-20 min, Benzodiazepines-IM,IV, PR
- Secondary Line Therapy 20-40 min, Keppra, Phosphenytoin, valproate, last choice-phenobarbital
- Third Line Therapy- 40-60 min, repeat dosing of above, then anesthetic dosing of midazolam, propofol, thiopental or pentobarbital with continuous EEG monitoring(neurology).

-Seizure associated injury can occur within 30 minutes

Courtesy of American Epilepsy Society

Seizure Diagnostics: EEG

- **EEG**: Non-invasive, provides seizure location and abnormalities such as spikes, slowing or silence.

-Records the frequency , amplitude and characteristics of brain waves.

Indication: AMS, seizures, subclinical seizures, identify location of seizures or adjunct in brain death.

- **Type**-short, sleep deprived, 24hour or continuous.

Seizure Diagnostics: CT

Advantages

- Sensitive to presence of blood, bones and lesions.
- Can be done quickly
- More readily available
- Fluid changes seen- hydrocephalus/cerebral edema.

Disadvantages

- Exposure to radiation-highest with abdomen.
- Need to think of cumulative affects.

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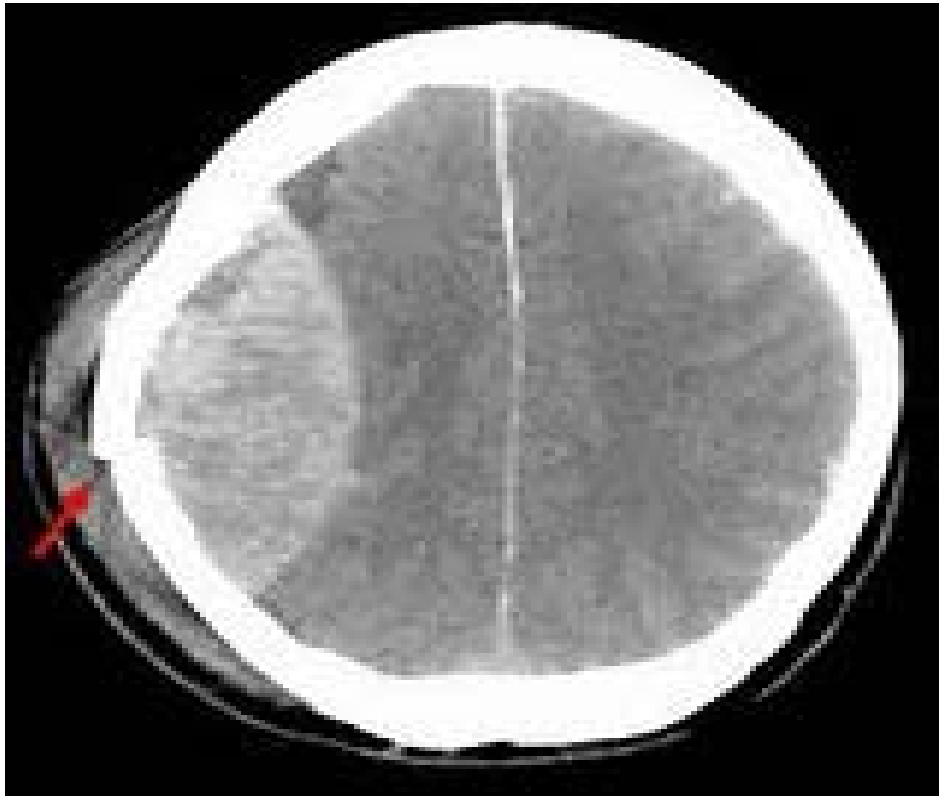
Seizure Diagnostics: CT

Identifies:

- Bony abnormalities
- Intracranial hemorrhage
- Hydrocephalus
- Cerebral edema
- Space occupying lesions and calcifications.



Seizure Diagnostics: MRI

Advantages

- Eliminates radiation exposure
- Higher resolution and differentiation of gray/white matter
- Higher resolution of skull base and orbits

Disadvantages

- Loud, dark and noisy
- Longer time of study-many children need sedation.
- Metallic devices will prohibit the study.

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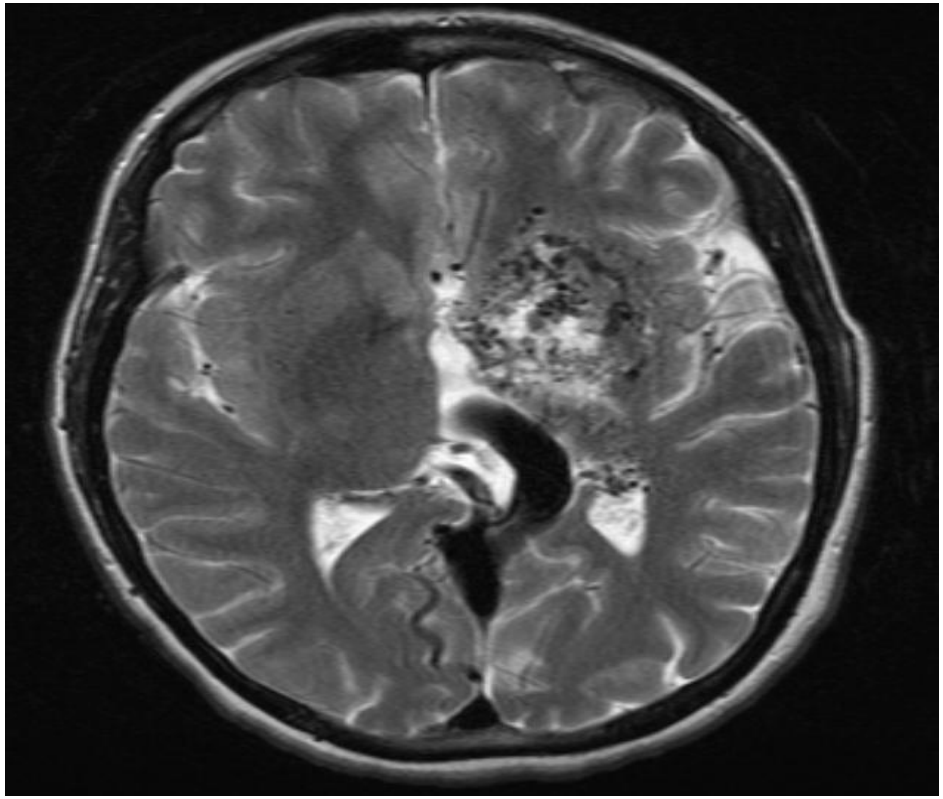
Seizure Diagnostics: MRI

Identifies:

- Ischemia or Infarcts
- Degenerative diseases
- Congenital anomalies
- AV malformations
- Posterior fossa or spinal cord lesions



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Seizure Diagnostics: Lumbar Puncture

- **Indication:** infectious, autoimmune or inflammatory process to include meningeal signs of neck stiffness and + Kernig and/or Brudzinski signs.
- **Age Specific**- infant aged 6 to 12 months has a seizure and fever without immunizations for Haemophilus influenzae type b (Hib) or Streptococcus pneumoniae or if his or her immunization status is unknown. Adolescent: Therapeutic to remove CSF in *Pseudotumor cerebri*
- LP also should be considered when a child with a seizure and fever has been **pre-treated with antibiotics**, because antibiotics can mask the signs and symptoms of meningitis but may not be sufficient to eradicate it.
- Measure opening pressure
- Contraindicated with high ICP-perfom CT first

Seizure Diagnostics: Lumbar Puncture

- **Procedure:** Lateral decubitus position or upright with procedural sedation prn and 1% lidocaine for local anesthesia
- LP below the level of the conus medullaris which ends at L1-2
- Iliac crest lines up with L3-4. Most common is completed at L4-L5. Can be L3-4 or L5-S1.
- Perform with sterile field, time-out and consent
- Pre-assemble manometer and collection tubes numerically for quick access and ensure special labs are ordered.
- Replace stylus before withdrawing needle
- **Post-procedure**-watch for CSF leak, headache, lower extremity sensory changes, hematoma at the site or AMS.

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Spinal Cord Injury

- Occurs with trauma
- Evaluation: Description and mechanism of injury, onset of symptoms, motor and sensory assessment, muscle strength and motor weakness evaluation.
- Typical trauma- fall from height, head, neck or spine trauma, MVC, diving, tumbling, contact sports, abusive head trauma.

Spinal Cord Injury

- Age specific considerations:
  - Infants have poorly developed cervical musculature, head is disproportionately large
  - Children less than age 9 have wedge shaped vertebral bodies, angled horizontally.
- Young children have cartilaginous endplates with lax interspinous ligaments, so they are more prone to SCIWORA (spinal cord injury without radiological abnormality).
- Children with Down syndrome are prone to atlanto-axial subluxation as a result of acute flexion injury

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Spinal Cord Injury Impairment Scale

Category	Scale	Defining Characteristics
A	Complete	No sensory or motor function preserved below S4 – S5
B	Incomplete	Sensory function present; no motor function preserved below the neurologic level extending through S4-S5
C	Incomplete	Motor function preserved below the neurologic level with muscle grade less than 3
D	Incomplete	Motor function preserved below the neurologic level with muscle grade of 3 or greater
E	Normal	Sensory and motor function preserved

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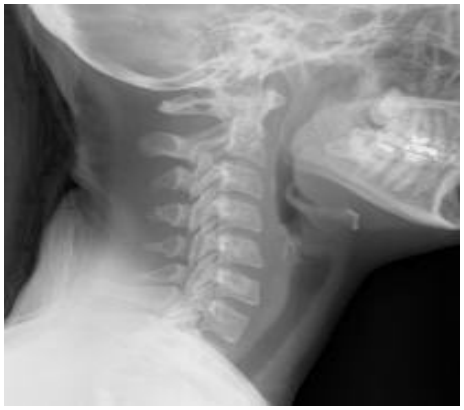
Diagnosis and Management

Diagnostics:

- Radiographs: head and neck films with lateral view, odontoid views
- Neck CT or MRI



Management:

- Manage airway
- Immobilize C-spine
- High dose IV steroids (30mg/kg)*
- Manage **neurogenic shock** with fluids, alpha-adrenergic agents, continuous monitoring. Spinal shock can last several days, causing paralysis and loss of tone with hypovolemia and hypotension.

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Traumatic Brain Injury

- **Traumatic Brain Injury:** direct trauma as primary injury or secondary injury from systemic (hypotension, hypoxia, anemia, etc) or intracranial problems such as tumor, cerebral edema, seizures or infection
- **CT Scan:** To scan or not to scan? Use PECARN or CHALICE Criteria
- **Acute monitoring:** ICP monitor, cerebral perfusion pressure (CPP) monitoring
- **Goal of TBI management:** Normal ICP, Optimize CPP, oxygenation and ventilation with appropriate cardiac output, B/P, surgical evacuation of masses, CSF or blood.

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TBI

Brain Trauma	Injury	Results
Primary	Intracranial contusion Extra-axial hemorrhage: epidural, subdural and subarachnoid Diffuse Axonal Injury	**Epidural hemorrhage**: injury to the middle meningeal artery or vein **Subdural hemorrhage**: bridging vein rupture **Subarachnoid hemorrhage**: tearing of small vessels in the pia mater
Secondary	Sequelae of local and systemic events	Ischemia Energy failure Cell death/apoptosis Secondary brain injury Axonal injury and death Cerebral edema Intracranial pressure increases or changes

Traumatic Brain Injury-Types

- **Epidural hematoma** – does not cross suture line, typically on side of direct impact, rapid accumulation of blood, often with fracture.
- **Subdural hematoma**: crescent shape, may cross suture line, but not midline, counter coup injury
- **Intraparenchymal hemorrhage**: bleeding within brain tissue
- **Intraventricular hemorrhage**: bleeding inside or around the ventricles of the brain
- **Hypoxic-ischemic injury**: initial CT may be normal, occurs and progresses over 24 – 48 hours, CT appears hyperdense

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Management

- Management: Rapid Sequence Intubation, Minimize increased intracranial pressure and secondary injury
- Follow Critical Pathway for Treatment of Established Intracranial Hypertension in Pediatric Trauma (Society of Critical Care Medicine (2012). (available on line: www.brain**trauma**.org/pdf/guidelines_**pediatric**2.pdf)
- Continued evaluation of symptoms is extremely important in children with moderate to severe brain injuries, but children with mild injury should also be monitored for changes in status and sequelae

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Mild Traumatic Brain Injury/Concussion Guidelines 2018

- Mild head injury where GCS is 13-15
- Usually no LOC-**refrain from routine imaging!**
- Standardized assessment of concussion for ages 6-18
- Assess for risks to recovery-previous injury, personal characteristics and family history, learning difficulties or stressors. Sideline testing during sporting events (SCAT5).
- Provide education for return to activities- when at pre-morbid state and symptom free at rest.
- Go to-https://www.cdc.gov/headsup/

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Cerebral Palsy

Motor impairment resulting from neurological insult, typically classified by type of movement problem:

- Spasticity-failure of muscle to relax
- Athetoid-inability to control the movement of a muscle
- Hemiplegic-involves one arm and leg on the same side of the body
- Diplegia-both legs
- Quadriplegia-all four extremities

Encephalitis

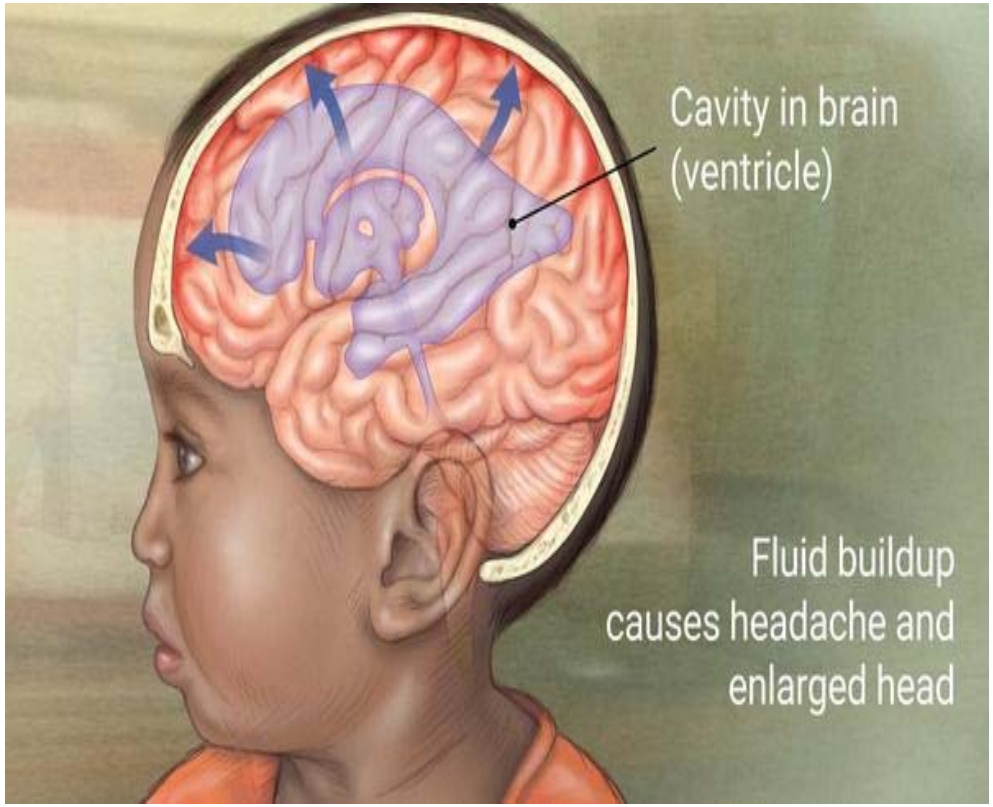
Acute inflammatory process of the brain parenchyma, often caused by a viral, bacterial, autoimmune or fungal process.

- Herpes simplex encephalitis (HSE), occurs in neonates infected at birth and in other young infants and is potentially lethal if not treated.
- Varicella-zoster virus encephalitis (VZVE) is life threatening in immune-compromised patients.

- **Symptoms:** Headache, aphasia, fever, AMS, ataxia, visual disturbances, seizures**.** Diffuse and/or focal neuropsychological dysfunction.
- **Management:** treatment of known cause and neurology consult with recommended diagnostic work up. EEG abnormal 90% cases. Therapy should be initiated with acyclovir in any young infant or child who is suspected of having viral encephalitis, especially those who appear ill. Cause often never known, may have irreversible brain damage.

Hydrocephalus

- An excess of CSF in the cranial vault due to either excess production, obstructed flow or defective drainage paths.
- May result in ventriculomegaly, increased ICP, macrocephaly and cognitive impairments.
- Signs and Symptoms: Rapid head growth, full or tense fontanel, irritability, vomiting, strabismus, inability to look up, apnea, dysphagia, hoarse or weak cry



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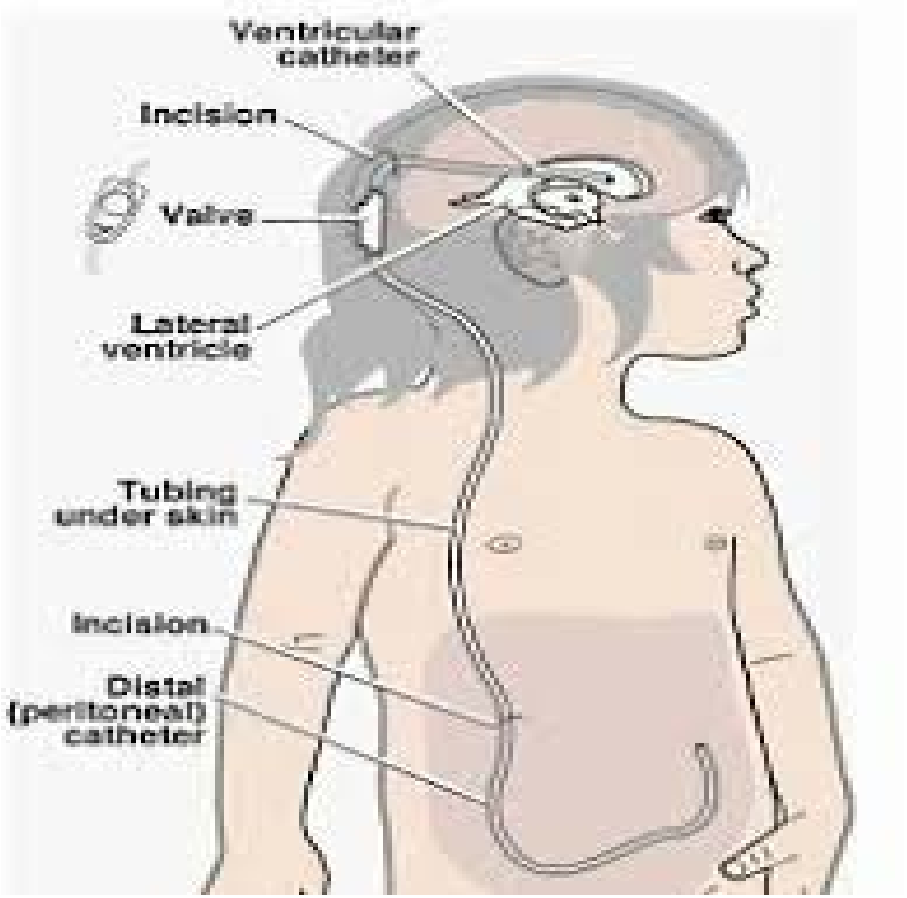
Hydrocephalus-Types

- **Communicating:** CSF flows out and within the ventricular system but is blocked from exiting.
- **Non-communicating or obstructive:** Blocked drainage occurs in any of the narrow passages that connect the ventricles.
- **Acquired:** Caused by injury or disease state
- **Congenital:** Genetic or fetal abnormality causes formation

Shunted Hydrocephalus

- Tubing and valve automatically drains fluid when pressure rises to set point to another body space for drainage.
- Types: VP-Ventriculo-pleural
- VA-Ventriculo-atrial
- VG-Ventriculo-gall bladder-less common
- Divided by where they drain. All have valves and tubing



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Shunt-Complications

Infection: 5-10%. Fever, Neck stiffness, Pain, Tenderness, Redness, Drainage from the shunt incisions or tract, AMS or Abdominal pain.

Malfunction: Blocked or broken: Seizures, pain, worsening cognitive function, speech impairment or dysphagia, limb or balance problems.

Overdraining or underdraining: Can cause hemorrhage, alter brain growth or hydrocephalus persists-must adjust valve, close follow up.

Diagnosis: Shunt series and CT scan, CSF tap and studies

Treatment: EVD and antibiotics with replacement of device when infection has cleared.

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Craniosynostosis

- Premature fusion of one or more of the cranial suture lines causing abnormal skull growth deformities and restriction if corrective surgery is not performed.
- Syndromes affected in 40% of cases-Aperts, Crouzons, Pierre- Robin, Turner, Goldenhar, VATER, Dandy-Walker.
- Associated brain abnormalities-hydrocephalus, Chiari malformation and increased ICP.
- Other associated abnormalities: Hearing loss, vision problems or limb abnormalities. May have cognitive or behavioral impairments.

Craniosynostosis

- Diagnostics-skull film, CT, 3-D CT, MRI
- Management: Surgery: Complex vault repair based on defect, bones broken. Endoscopic approaches now used with less complications but may be more costly.
- -Post-op Complications: **Pain and Bleeding**! May also see: SIADH, bradycardia, fever, seizures and facial edema or transfusion related complications.
- Younger patients have less complications, many have late diagnosis.

Additional Neurologic Problems

Botulism: progressive, descending, symmetrical, neuromuscular weakness as a result of presence of *C. botulinum spores* in stool.

- Infant less than the age of 12 months,may have exposure to contaminated soil, honey or water.
- **Signs: Constipation**, Hypotonia, listlessness, dysphagia, weak cry, decreased gag reflex and Latent ophthalmoplegia.
- **Diagnosis:** identification of *C. botulinum* spores in feces/clinical features.
- Treatment is botulism specific IVIG (BIG-IV) obtained only through the California Department of Health.

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Additional Neurologic Problems

Guillain-Barre Syndrome*:* progressive neuromuscular weakness

- Presents 4 – 6 weeks after a viral illness or prior infection.
- Symptoms are **progressive** and **symmetrical** with **ascending** paralysis.
- Pain, numbness, tingling of the extremities and sensory loss with gait disturbances.
- Management: diagnosis is through CSF protein measurement and clinical findings. Treatment IVIG and or plasmapheresis .

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Additional Neurologic Problems

Muscular Dystrophy*:* diagnosed by age 2.

The limb girdle muscular dystrophies have **progressive, symmetrical proximal** weakness with genetic link.

- Concern for progressive neuromuscular weakness which will eventually involve respiratory center and require various ventilation support.

Additional Neurologic Problems

Spinal Muscular Atrophy (SMA)*:* neuromuscular disease of childhood. Symptoms include weakness at birth or within the first year of life, feeding, breathing difficulties.

- Type I or Werdnig Hoffman, early diagnosis by 6 months.
- Type 2 = intermediate, usually can sit, but not stand or ambulate. Fine motor tremor of hands, tongue fasiculations
- Type 3 or Kugelberg-Welander, presents after age 18 months and walk. Weakness to proximal muscle groups. Weak lower extremities. Could live full life but wheelchair dependent.

Additional Neurologic Problems

- **Stroke:** Sudden interruption of arterial or venous blood flow to a focal region of the brain.

Ischemic: Disruption of blood flow leads to brain dysfunction from hypoperfusion, thrombus or embolism.

Hemorrhagic: A rupture of a vessel or aneurysm that leaks into surrounding tissues and cells.

Presentation: AMS, seizures, focal deficits, aphasia, visual deficits

Follow AHA National Stroke guidelines

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Additional Neurologic Problems

- **Acute Disseminated Encephalomyelitis-ADEM**

Brief but widespread inflammation of the brain and spinal cord that damages the myelin(white matter)-usually follows bacterial or viral illness.

Symptoms: Rapid onset of Encephalitis like illness-fever, fatigue, headache, N/V. Severe-seizures and coma, vision loss, weakness or paralysis.

Treatment: Steroids, IVIG or plasmapheresis, can relapse.

Additional Neurologic Problems

- **Posterior Reversible encephalopathy Syndrome-PRES**

Constellation of symptoms and radiologic abnormalities resulting from disruption in the blood brain barrier with radiologic evidence of vasogenic edema at occurs most frequently in the posterior brain circulation but can be seen elsewhere.

- Most instances is reversible, may occur in other areas of the brain and rarely the spinal cord.
- Most common presenting symptom in pediatrics is:

SEIZURES

- Other sxs: Hypertension, headaches, visual disturbances, focal neurological deficits, N/V, altered level of consciousness

Additional Neurologic Problems

- **Brain Death**
- Clinical diagnosis defined as the irreversible loss of all brain functions (including brain stem).
- Coma, apnea, and the absence of brainstem reflexes are essential findings in brain death.
- Potential **reversible** causes of coma should be excluded
- Two examinations performed by different attending physicians must be completed separated by an observation period of 24 hours for neonates (37 weeks gestation to term infants 30 days of age) and 12 hours for infants and children (>30 days to 18 years). State by state variability.

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Additional Neurologic Problems

- **Pseudotumor Cerebri**
- Rapid reproduction of ones' own cerebral spinal fluid.
- Visual loss is a potential complication.
- Goal of treatment is vision preservation and alleviation of symptoms.
- Visual field testing, dilated fundoscopic exam and imaging of optic disks are necessary for proper diagnosis
- Lumbar puncture is diagnostic and is a treatment for PTCS. Hallmark opening pressure would be greater than 280 mm

Additional Neurologic Problems

- **Arteriovenous malformation AVM**
- Congenital intracranial malformation distinguished by a persistently abnormal connection between arteries and veins within the brain without an interposed or developed capillary bed
- associated with neurological deficits such as hemiparesis, seizures and speech may be affected.
- Management includes ABCD, close ICP control
- Cerebral angiography is considered the gold standard study to identify the arteries involved
- May need surgical clipping, craniectomy or embolization

Additional Neurologic Problems

- **Hypoxic Ischemic Encephalopathy-HIE**
- Consequence of prolonged hypoxia, cerebral edema is a result and neurologic sequela will occur.
- Occurs: birth trauma, submersion injury, asphyxiation, accidents or intentional, prolonged resuscitation, stroke.
- Management: Prevent secondary injury and ICP control, keep electrolytes, pH osmolarity normal. Control seizures.
- Studies: EEG, CT-acute hemorrhage, cerebral edema, MRI vascular or hemorrhage

Additional Neurologic Problems

- **Neurofibromatosis**-Inherited disorders characterized by tumors in the brain, spine, skin or eyes.
- Type 1 or Type 2
- Dx: Usually diagnosed by age 10. 90% of cases have café au lait spots. Lisch nodules(hamartomas of the iris) are pathognomonic. Vestibular and cutaneous schwannomas can be present.
- At risk for neurocognitive deficits, Autism, ADHD, meningiomas, malignancies/tumors
- Management: Tumor removal, Close neurologic, hearing and opthothalomalomogic follow up.

Additional Neurologic Problems

- **Tuberous Sclerosis Complex** Autosomal dominant disorder, develop benign tumors that develop in the brain, skin, kidneys.
- Features: hypomelanotic fibromas, cortical tubers, subependymal nodules or astrocytoma, facial angiofibromas, fibromas, lymphangioleiomyomatosis, hamartomas, bone or renal cysts
- Diagnosis: Definite: 2major features, 1major and 2 minor.
- Mild to severe. Infants with seizures, cardiac rhabdomyomas, ash leaf spots. Seizures can be refractory.
- Management: Symptom dependent. Seizure control. Immunosuppressant therapy may be helpful (not approved). Tumor removal.

Long Term Management: Neurology

- Multi-system problems!
- Complex care/Medically fragile
- Rehabilitation and medical home management.
- Chronic care of child with TBI or CP includes collaboration with services such as Rehab medicine, physical therapy, speech and language, school services, neurology and other sub-specialty services.

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Acute Care Pediatric Nurse Practitioner Review Course

Sedation and Analgesia

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Objectives

- Discuss the evaluation and management of pain, sedation and delirium and pharmacologic interventions used in pediatric critical care.

Pain Evaluation

Classification of pain:

- **Nociceptive:** somatic pain
- **Neuropathic:** pain due to nerve damage
- **Functional:** abnormal presence of pain pathways system

- **Acute:** Short lived, occurs with injury due to thermal, mechanical or chemical stimulus
- **Chronic:** Any pain that lasts longer than a month.

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Details in Children

- **Developmental Considerations:** type of medication, how administered
- **Pharmacologic Issues**: related to age and metabolism.

  Higher body water content in young infants.

  Protein binding of certain drugs.

  Volume of Distribution, obesity

  Habituation or previous sedation

- **Assessment:**

  Multiple assessment scales available based on age, and available for self-report and subjective evaluation.

*Analgesia and Sedation are often used together for critically ill children with ventilatory or other invasive needs.

Types and Classes of Pain Medications

- **Opioids**: morphine, oxycodone, methadone, fentanyl
- **Analgesics:** acetaminophen
- **Non-steroidal anti-inflammatory drugs (NSAIDS)**: Ibuprofen, Toradol, Aspirin
- **Anti-epileptics and Antidepressants:** adjunctive-used for neuropathic pain-topamax, gabapentin, tricyclic's, SSRI's.
- **Anesthetic agents** – IV-Ketamine, Propofol, Precedex and topical (EMLA), local-injections-blocks, caudals, epidurals and inhaled agents.

Opioid Habituation

- Pain: subjective measurement
- 2.5 million Americans addicted- 2/3 start medications in physician offices
- Prescriptions to children have doubled in last 10yrs
- <12% receive any treatment
- Multi-disciplinary support with psychosocial treatment and medication.
- Diagnosis: Urine drug screen
- Treatment: Slow withdrawal. AAP clinical management strategy (2014).

Methadone: physiologically dependent on opioids.

Buprenorphine: Used for mild-to-moderate opioid withdrawal to reduce risk of precipitated withdrawal.

Naltrexone: Recommended for preventing relapse.

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Dependence/Addiction

Dependence

Physical adaptation to an opioid manifested by withdrawal syndrome produced by abrupt cessation of the drug, rapid dose reduction, decreasing blood level of the drug, and/or administration of an antagonist.

(Nierengarten, M. Pediatrics, 2016)

Addiction

Primary, chronic, neurobiological disease with genetic, psychosocial, and environmental factors that influence its development, and is characterized by such behaviors as impaired control over opioid use, compulsive use, continued use despite harm, and craving.

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Sedation Medications

Medication	Classification/Use
Midazolam	Benzodiazepine/ Procedural sedation, sedation for ventilation, etc. short-acting.
Lorazepam	Benzodiazepine/Acute seizure management, Agitation
Diazepam	Benzodiazepine/ Muscle tremors/spasm
Haloperidol	Antipsychotic/Delirium, Agitation, Irritability, as adjunct for longer term sedation with other agents.
Propofol	Anesthetic agent/ Sedation weaning, short-acting. Associated with propofol infusion syndrome/acidosis, need limited time of therapy. Burning at infusion site.

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Sedation Scores-
Those supported on mechanical ventilation scored on the following:

State Behavioral Score

-Respiratory drive, coughing, best response to stimulation, attentiveness to provider, tolerance to care, movement to consoled.

Scores from -3 to 2 or unresponsive to agitated. Goal is 0.

Richmond Agitation Scoring System

- Longer range of scores from dangerous to self to frequent non-purposeful to goal 0 calm to lightly sedated, moderate and deeply sedated.
- Scores from +4 to -5 or from Combative to unarouseable.

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Procedural Sedation

- Safe to sedate??-Screen them!

-AMPLE mnemonic

Allergies, **M**edications, **P**ast Illnesses, **L**ast oral intake, **E**vents leading up to injury

- Consent
- Age and developmental specific differences
- Underlying problems or behavior disorders-may require alternative medications or have unexpected effects of medications
- Team sport-need nurse, respiratory support, safe room with immediate access to emergency age appropriate equipment

ASA Class

ASA

Class 1-normal/healthy

Class 2-Mild systemic disease

Class 3-Severe systemic disease-non-decompensated

Class 4-Severe systemic disease-decompensated

Class 5-Moribund-unlikely survival

-Class 1-3 safest, <4 weeks high risk

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Mallampati Score

Mallampati Score

Score that describes ability to visualize the pharynx

Class 1-Uvula, soft palate,

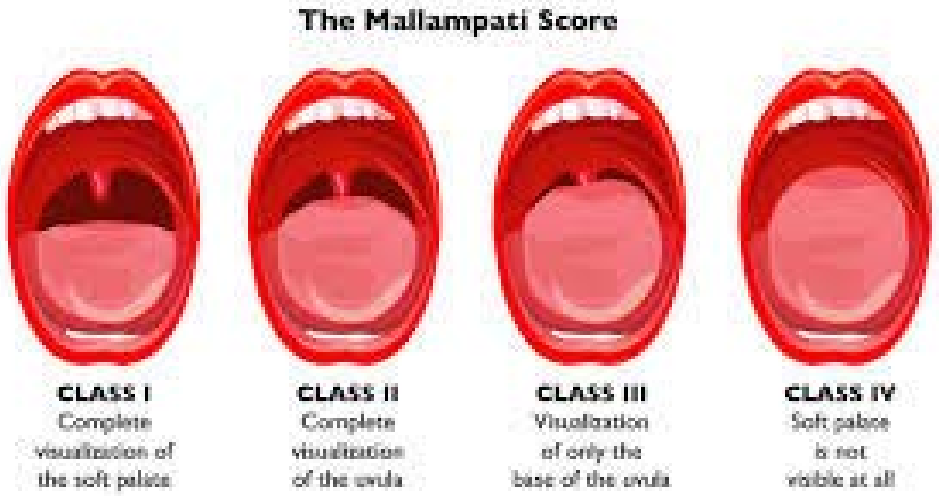
tonsillar pillars

Class 2 Soft palate and uvula

Class 3 Base of uvula

Class 4 Hard Palate only

-Class 1&2 safest.



Neuromuscular Blockade

- Reserved for critically ill children usually for the purpose of controlled ventilation.
- Must administer with sedatives and analgesics!
- Know total time of action prior to administration, especially with intubation!
- Need for “drug holidays” -goal for lowest needed dose
- Long-term sequelae

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Pediatric Delirium

- What is delirium?
  - "a disturbance of consciousness and cognition that develops acutely with a fluctuating course of inattention and an impaired ability to receive, process, store or recall information"

    --Smith et al, 2009

- A frequent and serious complication of critical illness with links to:
  - Increased mortality
  - Prolonged hospital stays
  - Long-term disability
  - A complication of hospitalization

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Delirium

- **Symptoms**
  - Impaired consciousness
  - Impaired awareness
  - Unable to focus
  - Sleep-wake cycle abnormalities
  - Thought processes disturbances
  - Behavioral issues

- **Risk factors**
  - Younger age (< 5 yrs)
  - Male gender
  - Pre-existing cognitive impairment/developmental delay
  - Hx of delirium
  - Family history of delirium
  - Pre-existing emotional and/or behavioral problems
  - Cyanotic heart disease
  - Longer mechanical ventilation time

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Delirium Evaluation

- Estimated **Occurrence** 20-30%
- Often related to agents used for sedation
  - Benzodiazepines
  - Propofol
  - Ketamine
  - Opioids

Types

- **Hyperactive**-or ICU psychosis, agitated, restless, inattentive
- **Hypoactive**-withdrawn, flat or apathetic
- **Mixed**-Waxes and wanes between both

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Pediatric Confusion Assessment Method or P-CAM

- Rapid: < 2 minutes
- Specific and sensitive for children >5 years
- Easy to use and starts with basic delirium.
- Acute or fluctuating mental state
- Inattention
- Altered LOC
- Disorganized thinking

Delirium Treatment

- Non-pharmacologic-circadian reset, frequent re-orientation, schedule for the day.
- Antipsychotics-Haldol most widely used across the lifespan. Prolonged Qtc or dystonic reactions.
- Atypical Antipsychotics- Resperidone, Zyprexa or Geodon have lower side effects. Blocks at multiple receptor sites, not just dopaminergic receptor sites as with haldol.

Sleep Disorders

- Obstructive Sleep Apnea-could affect growth-need sleep study to formally evaluate
- ENT evaluation for possible T & A or obstruction
- Nutrition consult if obese
- Screen for other conditions-night terrors, enuresis, anxiety
- Delirium-Assess for presence, hospital not a place for rest
- Medication side effect-Stimulants, OTC medications, watch for “natural” sleep aids.

Question

An 10 year old with history of obstructive sleep apnea, obesity, admitted with osteomyelitis needs a PICC line for long-term antibiotic therapy. Which sedation plan is MOST appropriate for this patient?

A Fentanyl and midazolam doses titrated to desired effects

B Single dose of propofol

C Single dose of fentanyl and midazolam

D Local anesthetic with child life therapist support during procedure

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Answer:

An 10 year old with history of obstructive sleep apnea, obesity, admitted with osteomyelitis needs a PICC line for long-term antibiotic therapy. Which sedation plan is MOST appropriate for this patient?

D. Local anesthetic with child life therapist support during procedure

Question

In a patient ventilated and sedated with new onset AKI which medication should be removed from their MAR?

A Vancomycin

B Pepcid

C Cefepime

D Toradol

Answer:

In a patient ventilated and sedated with new onset AKI which medication should be removed from their MAR?

D. Toradol

Question

A 1 year old with head injury develops acute irritability with decreased sensorium and bradycardia. The most important urgent management includes intubation and:

A. MRI brain and administration of mannitol

B. CT Brain and administration of hypertonic saline

C. CT brain and administration of furosemide

D. MRI brain and administration of hypertonic saline

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Answer:

A 1 year old with head injury develops acute irritability with decreased sensorium and bradycardia. The most important urgent management includes intubation and:

B. CT Brain and administration of hypertonic saline

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Question

An afebrile sedentary adolescent female is seen in the ER for headache and worsening vision disturbances. The family is concerned for meningitis. What is the next course of treatment?

A Head CT

B Lumbar puncture

C Formal eye exam

D Nutrition consult

Answer:

An afebrile sedentary adolescent female is seen in the ER for headache and worsening vision disturbances. The family is concerned for meningitis. What is the next course of treatment?

C. Formal eye exam

Question

Which imaging modality is best to diagnose hydrocephalus?

A MRA

B CT

C MRI

D Perfusion Scan

Answer:

Which imaging modality is best to diagnose hydrocephalus?

B. CT

Question

The acute care PNP on service is asked to sedate a 28 day old with ASA score of 3 for MRI. What is the best choice?

A Screen and evaluate

B Complete the sedation

C Defer to sedation service

D Check NPO status

Answer:

The acute care PNP on service is asked to sedate a 28 day old with ASA score of 3 for MRI. What is the best choice?

C Defer to sedation service

Evaluation and Questions

- Remember to

Relax!!

- It will all be over

Soon and you will

Be successful!!!

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