

MEDICAL COMPLICATIONS AFTER TRAUMATIC BRAIN INJURY

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AGENDA

- Dysphagia
- Infection
- Cardiac
- VTE and PE
- Bowel and Bladder dysfunction
- Pressure ulcers
- Post-traumatic Hydrocephalus
- Visual impairments
- Seizure
- Paroxysmal sympathetic hyperactivity
- Spasticity
- Cognitive d/o

Medical Complications after Brain Injury

- Increase hospital length of stay
- Worsen functional outcome
- Risk factors
 - Severe Brain Injury
 - Older age
 - Preexisting comorbid medical conditions
 - Duration of ventilation

Dysphagia

- Due to incomplete oral clearance, impaired pharyngeal response and palatal asymmetry
- Increased risk of pneumonia
- Risks: Age > 70, male, more severe injury
- Evaluation:
 - SLP consult
 - Bedside swallow eval
 - Easy to perform
 - low sensitivity
 - Looking for a cough or voice change
 - Video fluoroscopy

Infection after Brain Injury

- **Pneumonia:**

- Most common cause of fever in first 48 hours
- Leading cause of hospital readmission in first 5 years
- Risks: age > 65 years, speech impairment, disability, cog impairment, dysphagia, DOC, facial weakness, mechanical ventilation

- **Prevention:**

- Elevated head of bed, assisted feeding, oral care, oral antiseptics, incentive spirometry

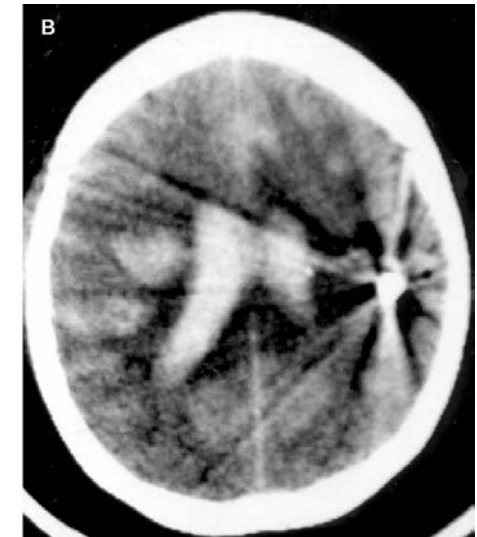


Infections

- **UTI:**
 - **Risk:** female, older age, severity of stroke, and need for catheterization
 - **Treat:** antibiotics, remove Foley and perform intermittent catheterization

Skull and Brain Infections

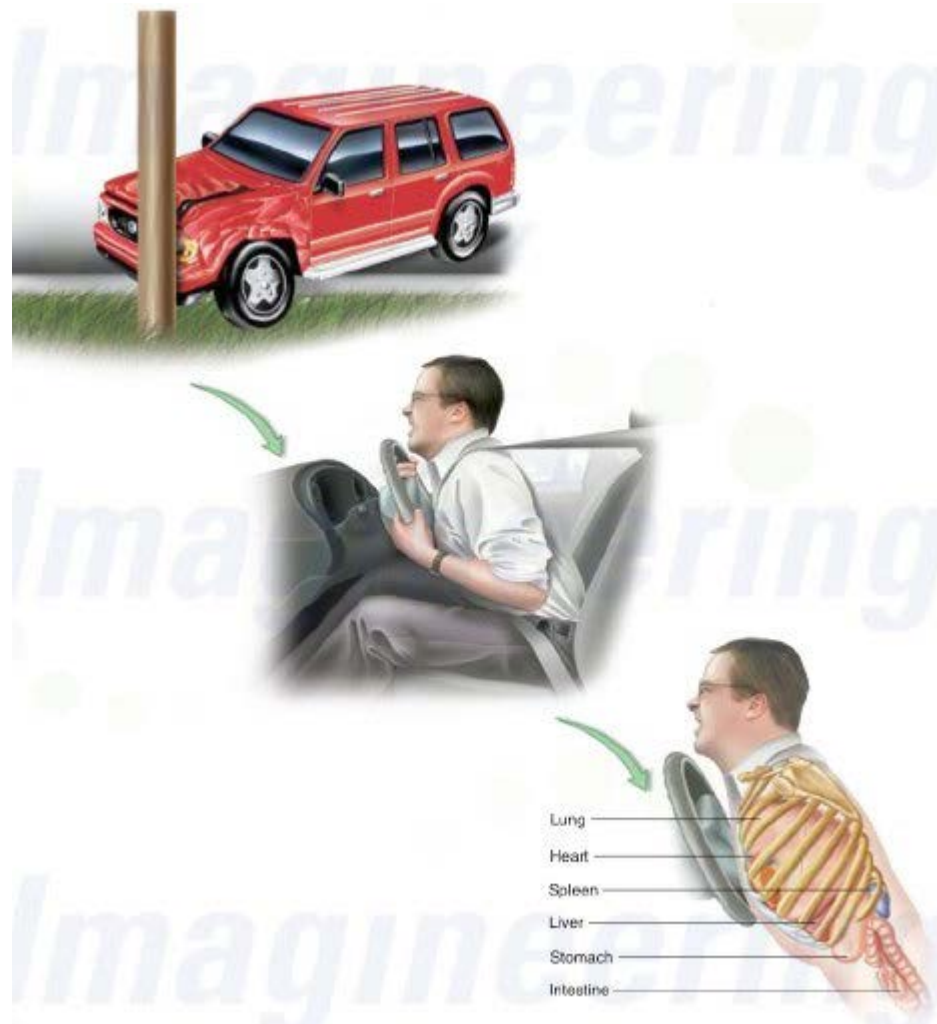
- GSW higher rate of infection, due to retained gun fragments, and path of necrosis
- Skull base fractures where sinus fistulas can form
- CSF Rhinorrhea
- Craniectomy incision wound dehiscence



gunshot injury; (B) cross-mid-sagittal, multilobar injury.

Cardiac

- TBI
 - “Steering wheel injuries”
 - Neurogenic stress cardiomyopathy
- Deconditioning and immobility
 - Tachycardia
 - Hypotension
 - Hypertension
 - LE edema



Venous Thromboembolism

- Risk: increased age, dehydration, hemiparesis, degree of weakness
- Prevention:
 - Intermittent compression devices
 - Contraindications
 - Fracture, arterial or venous insufficiency, heart failure, thrombophlebitis, DVT
 - Unfractionated heparin (UFH) or low molecular weight heparin (LMWH)
 - UFH administered every 8-12 hours
 - LMWH usually once daily



VTE and PE

- Anticoagulation often initially contraindicated in intracranial/cerebral hemorrhage



Bowel dysfunction

– Constipation:

- Results in pain and decreased nutrition, impaction
- Risks: decreased mobility, dysphagia, dysfunctional contractions, deficits in cog, consciousness, and communication

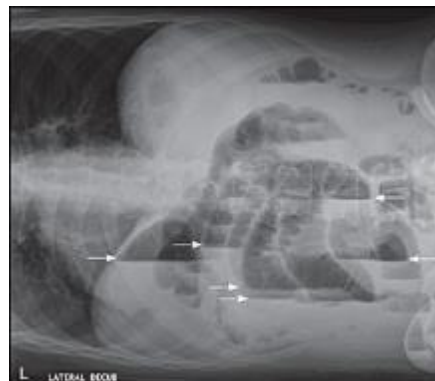
– Fecal incontinence:

- Risk: older, greater severity TBI, other disabling conditions



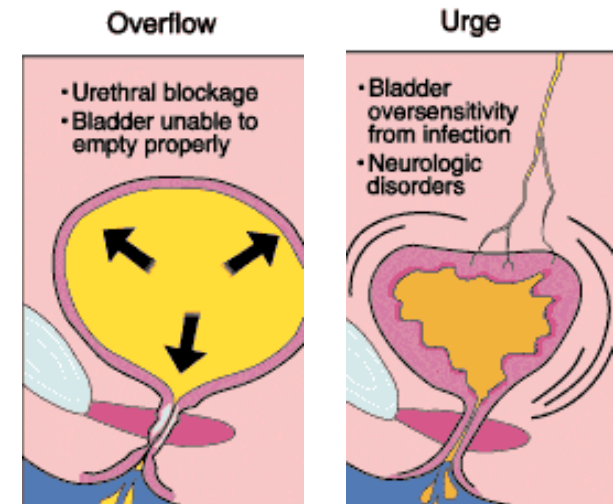
Evaluation and Treatment of Bowel Dysfunction

- Physical exam – abdomen and possibly rectal
- Abdominal xray – upright and lateral decubitus
- Bowel program (fiber and fluid)
 - Meds: psyllium husk: must take in enough water
 - Docusate, miralax softeners
 - Senakot and bisacodyl: stimulant



Urinary Incontinence and Retention

- **Incontinence:** incidence as high as 80%
 - Results in: skin breakdown, discomfort, decreased social interaction and higher mortality
 - Medical consequences: bladder infection, reflux hydronephrosis and renal failure
- **Causes:**
 - Retention and overflow
 - Detrusor over activity
 - Detrusor-sphincter dyssynergia



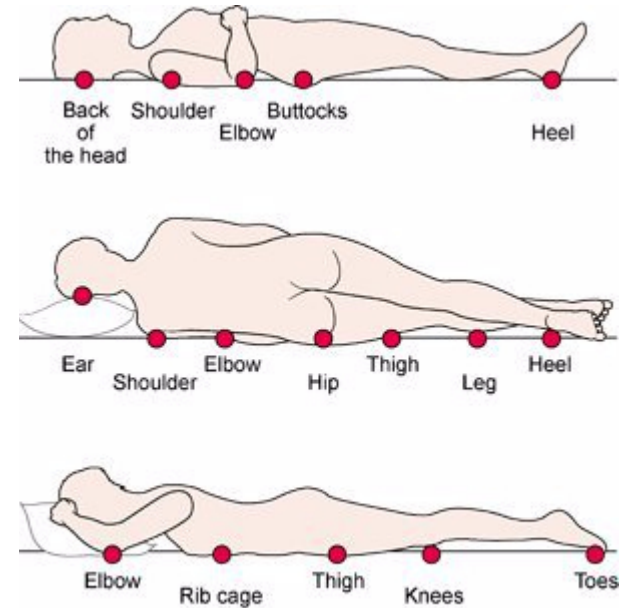
Urinary Incontinence and Retention

- **Evaluation**
 - UTI – urinalysis and culture
 - Bladder scans and post void residuals
- **Treatment**
 - **Retention:**
 - Schedule intermittent catheterization
 - Medication: alpha blocker
 - **Detrusor over activity**
 - Timed voiding
 - Anticholinergic medications



Pressure Ulcers

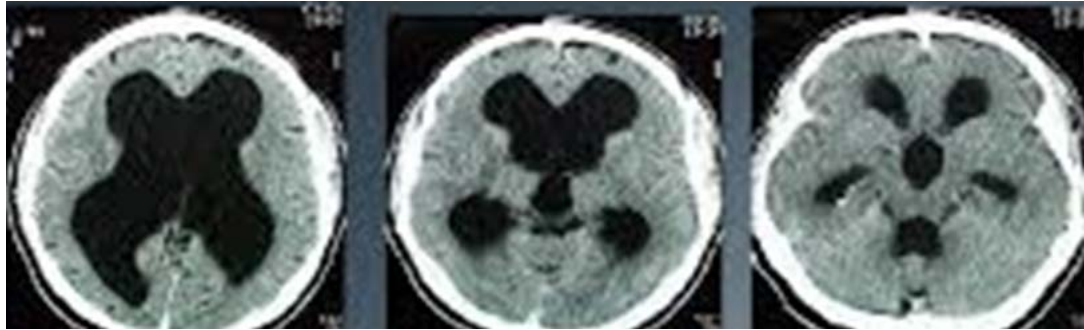
- **Risks:**
 - Impaired mobility
 - Decreased nutrition
 - Altered level of consciousness
 - Impaired sensation
 - Bowel and bladder incontinence
- **Locations:** occiput, scapula, sacrum, buttocks and heels
- **Rx:** treat underlying problem (risks)



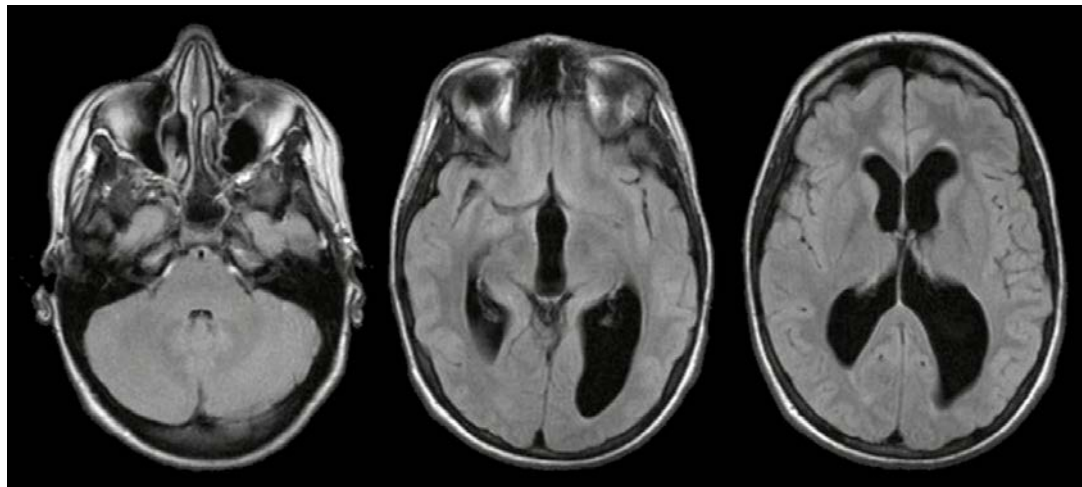
Post-Traumatic Hydrocephalus (PTH)

- Most common after TBI is communicating hydrocephalus
- Due to an imbalance between CSF production and absorption
- Most common treatable neurosurgical complication
 - Incidence of 45 % in severe TBI
- Symptoms:
 - Headache
 - Nausea or vomiting
 - AMS, lethargic
 - Failure to progress in therapy
 - Cushing triad (hypertension, bradycardia, hypoventilation)

Communicating (Non-Obstructive) Hydrocephalus

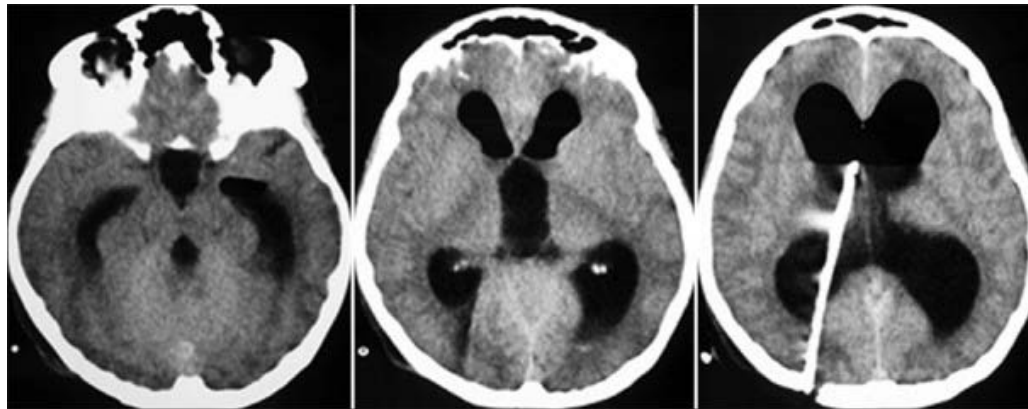


Non-Communicating (Obstructive) Hydrocephalus



PTH

- **Treatment:** must relieve the pressure!
 - External Ventricular Device (EVD)
 - Shunting
- Monitor for over-draining and under-draining



Salt disorders - Hyponatremia

- **Syndrome of inappropriate ADH secretion (SIADH)**
 - Euvolemic (normal hydration)
 - Treatment: fluid restriction, salt tabs, hypertonic saline
- **Cerebral salt wasting**
 - Hypovolemic (dehydrated)
 - Treat with hydration / fluid replacement and electrolyte (Na) correction

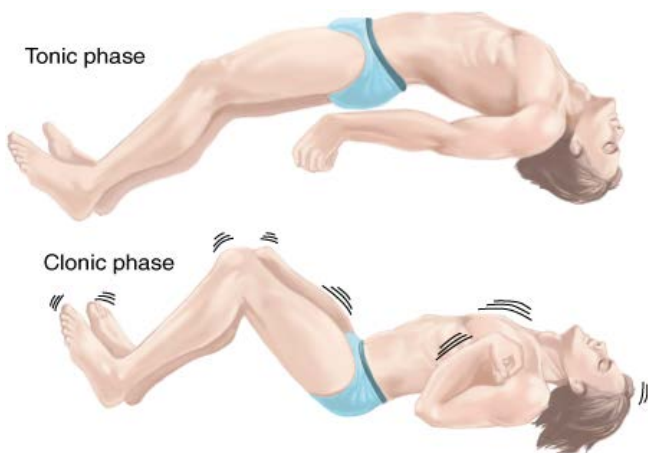
Salt Disorders - Hypernatremia

- **Diabetes insipidus: Deficiency of ADH**
 - Associated with skull fractures
 - Polyuria, polydipsia, excessive thirst
 - Treatment:
 - Drink to thirst
 - Hormone replacement
 - DDAVP (desmopressin acetate)



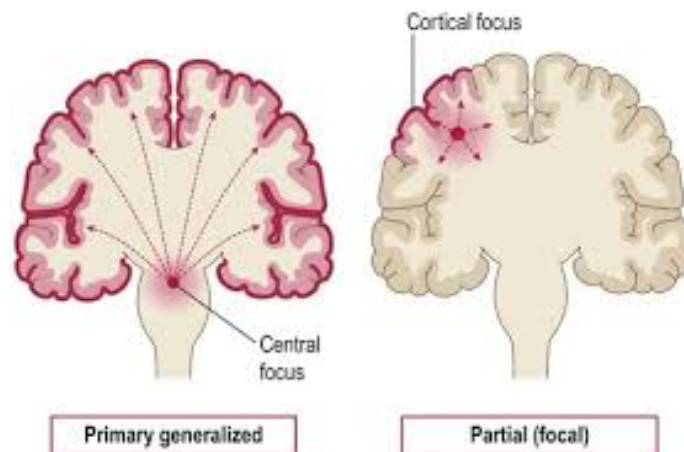
Post Traumatic Seizures (PTS)

- **Partial (focal) seizures**
 - Originate in localized area of 1 cerebral hemisphere
 - Simple partial: conscious (***majority of PTS***)
 - Complex partial: unconscious
- **Primary generalized seizures**
 - Generalized tonic-clonic seizure / generalized convulsive seizure



Source: McKean S, Ross JJ, Dressler DD, Brotman DJ, Ginsberg JS: *Principles and Practice of Hospital Medicine*: www.accessmedicine.com

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Classification of PTS

- **Immediate**
 - First 24 hours
- **Early**
 - Occurs within the first week (24 hours – 1 week)
- **Late**
 - Occurs after the first week
- 7 days AED standard prophylaxis

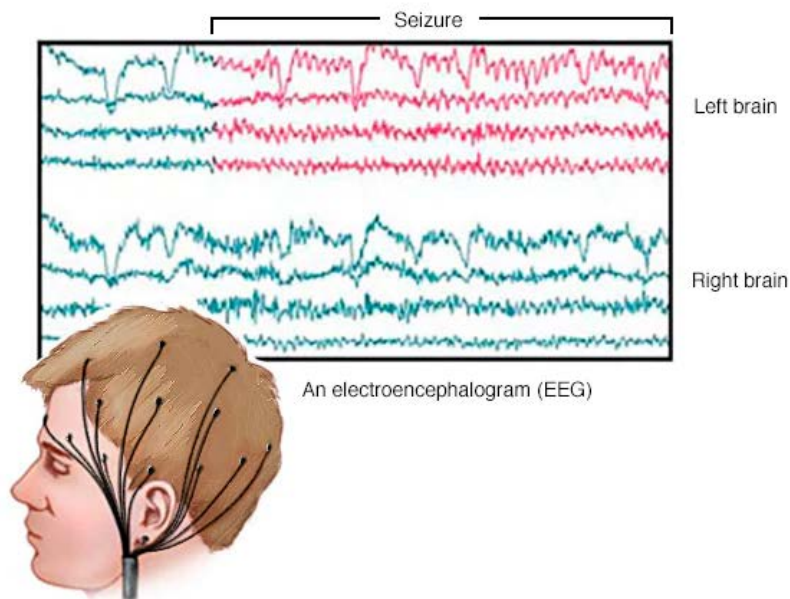


Epidemiology of PTS

- Varies according to severity of the injury, time since the injury and the presence of risk factors
 - **most occur 1-3 months post-injury**
- 5% of hospitalized TBI patients have early PTS
- 4-7% of hospitalized TBI patients have late PTS
- 50-66% of PTS occur within 1 year and 75-80% occur within 2 years

Risk Factors for Late PTS

- Brain contusion
- SDH
- Skull fracture
- Loss of consciousness
- Amnesia > 1 day
- > 65 years old
- Family history of seizures
- Alcohol abuse

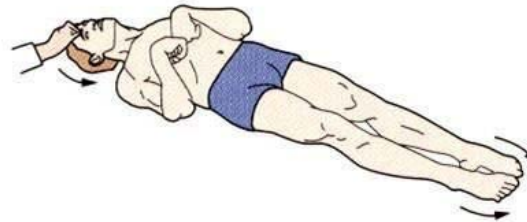
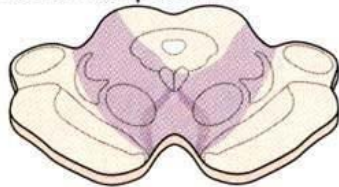


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Paroxysmal Sympathetic Hyperactivity (PSH)

- Syndrome of simultaneous and paroxysmal sympathetic and muscle over-activity following severe TBI
- Excessive activation of the sympathetic arm of the ANS due to direct trauma to the autoregulatory centers
 - Exaggerated response to physical and environmental stimuli

Upper midbrain damage
Decorticate posture

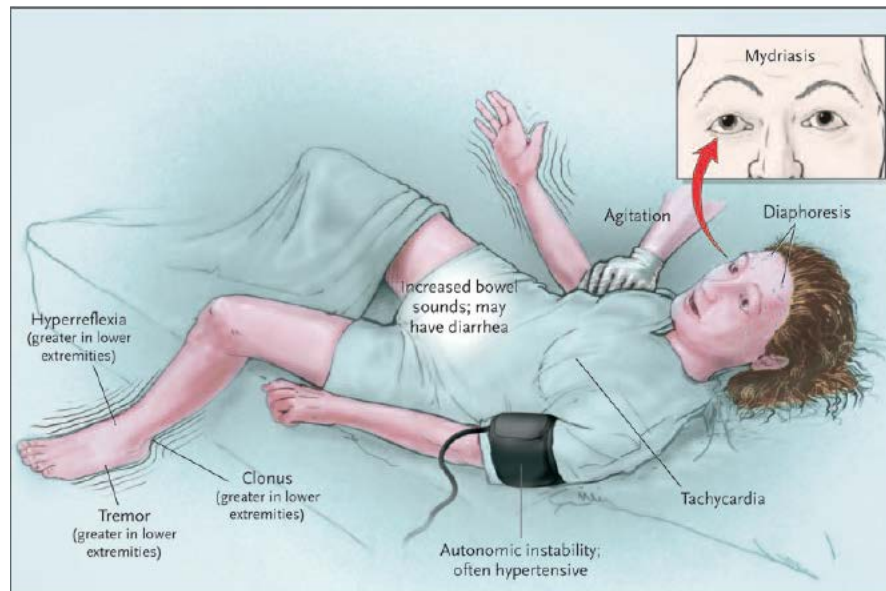


Upper pontine damage
Decerebrate posture



PSH

- Occurs within 2 weeks of injury
- Diagnosis of exclusion
 - Clinical features coexist with other medical complications (ie sepsis, pain, withdrawal)



PSH: Diagnosis

- **Clinical Features:** typically 5 out of 7 for at least 3 days
 - Tachycardia (>120 bpm)
 - Tachypnea (>30/min)
 - Increased temperature (>38.5°C)
 - Elevated SBP (>160 mmHg)
 - Excessive sweating
 - Increased muscle tone
 - Decorticate/decerebrate posturing
- **Lab Findings**
 - Elevated creatinine kinase levels
 - Elevated catecholamine production

PSH: Treatment

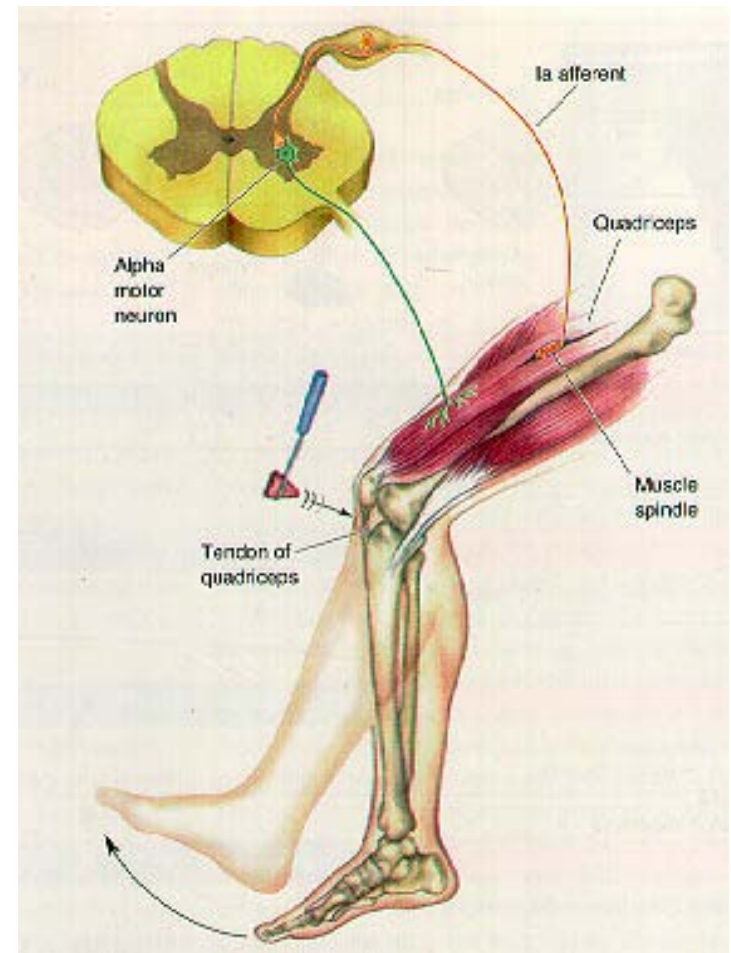
- Gabapentin
- Lipophilic beta-blockers for HTN/tachycardia
 - Propranolol and labetalol
- Dantrolene sodium for malignant hyperthermia
- NSAIDs, acetaminophen, baclofen
- Cooling blankets, NG tube lavage
- Dopamine agonists: amantadine, bromocriptine
- Intrathecal baclofen

Spasticity

- Is an upper motor neuron sign due to injury to CNS
- Velocity-dependent increased resistance to passive stretch
- Other upper motor neuron signs include:
 - Clonus
 - Pronator Drift
 - Co-Contraction
 - Flexor and extensor spasms
 - Dystonia
 - Associated reactions
 - Muscle stiffness
 - Joint contractures

Proposed Physiology of Spasticity

- Follows reflex pathway
- Muscle wants to maintain tone
- Much worse when damage to the brain than spinal cord



Common Patterns in Upper Extremity



The Adducted/Internally Rotated Shoulder



The Flexed Wrist



The Pronated Forearm



The Clinched Fist



The Flexed Elbow



The Thumb-in-Palm Deformity

WE MOVE

Common Patterns in Lower Extremity



Equinovarus



Stratial Toe



Stiff Knee



Flexed Knee



Adducted Thighs

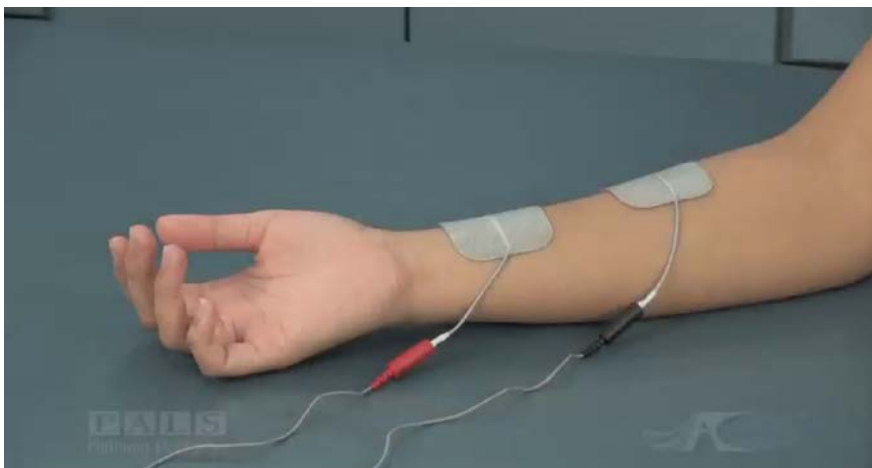
WE MOVE

Goals of Treatment

- Reduction of muscle over activity without affecting voluntary motor control
- Improve
 - function
 - sitting
 - ambulation
 - positioning
 - cleanliness
- Facilitating fitting of an orthotic device

First Line Treatment

- Therapy:
 - Positioning, Strengthening antagonist, bracing, casting, taping, e-stim

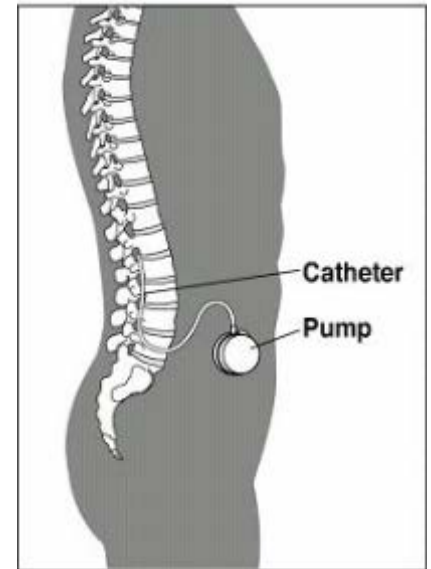


Pharmacology Interventions

- Includes:
 - Baclofen
 - Tizanidine
 - Dantrolene Sodium
 - Diazepam
 - Cyclobenzaprine
 - Botulinum toxin injections
- Note:
 - Use in conjunction with therapy
 - Botulinum toxin injections give local relief of spasticity to targeted muscles while other medications are diffuse

Intrathecal Baclofen

- Baclofen is stored in pump reservoir implanted subcutaneously and dosed intrathecally, continuously
- Catheter placement tip can be lumbar- to cervical
- 100 fold reduction in baclofen dose



ITB Withdrawal or Overdose is an Emergency

- Withdrawal:
 - Increased spasticity
 - Rigidity
 - Fever
 - Tachycardia
 - Itching (feeling as insects under skin)
 - Hallucinations/Delirium
- Overdose
 - Respiratory depression
 - Sleepy
 - Flaccid tone
 - Urinary retention

Cognitive-Behavioral Disorders

- Agitation
- Restlessness
- Disinhibition
- Confusion
- Poor initiation
- Personality change
- Pseudobulbar affect
- Catatonia
- Emotional:
 - Emotional lability
 - Depression
 - Hypomania/mania
 - Anxiety
 - Anger
 - Apathy



Executive function

- Described as :
 - Mental processes that connect past knowledge with present action
 - Planning
 - Organizing
 - Strategizing
 - Managing time and space



Dr.. Thomas Brown

Executive function testing

- **Galveston orientation and amnesia test (GOAT)** for PTA
- **O-Log** for PTA
- **MMSE**: Mini mental status exam
- **MOCA**: Montreal Cognitive Assessment
- **DRS**: Disability rating scale
- **GOS**: Glasgow outcome scale
- **FIM** cognitive score
- **Neuropsychological testing**

Pseudobulbar Affect

- Uncontrollable laughing, crying, or other emotional displays that are disproportionate or inappropriate to the social context
- Secondary to injury to the CNS
- **Treatment:**
 - SSRI, TCAs
 - Dextromethorphan with quinidine



Catatonia

- Inability to move normally
- Underlying psychiatric or medical disorder
- **Most common symptoms:**
 - immobility, rigidity, mutism, posturing, excessive motor activity, stupor, negativism, staring, echolalia
- **Treatment**
 - Benzodiazepines
 - Electroconvulsive therapy



Summary

- TBI affects millions of people in the US
- The injury itself and the deficits as a result of the TBI often results in medical complications
- These medical complications can impair a patient's ability to participate in rehab, therefore limiting progress
- Our interdisciplinary rehab team is able to monitor the patient for these complications and treat as needed



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THANK YOU

