North Carolina Academy of Physician Assistants

Recertification Exam Review

Tuesday, February 25th, 2014
10:30am-12:30pm

NEUROLOGY REVIEW

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Learning Objectives

At the end of this session participants will be able to:

• Describe the epidemiology data, pathophysiology, and risk factors associated with select neurological disorders

• Discuss typical and atypical clinical features of select neurological disorders

• Explain an approach to assessing patients with neurological complaints, including pertinent history, physical exam findings, and diagnostic studies

• Describe principles of managing select neurological disorders, including both pharmacological and behavioral interventions
10:30am-11:20am

• Anatomy & Physiology of the Neurological System
• The Neurologic Evaluation
  – History
  – Physical Examination
  – Diagnostic Tests
• Vascular Disorders
  – Transient ischemic attack
  – Ischemic Stroke
  – Intracerebral Hemorrhage
  – Subarachnoid Hemorrhage
• Multiple Sclerosis
• Gullain-Barre Syndrome
• Myasthenia Gravis
• Cerebral Palsy
• Seizure Disorders
• Questions
• BREAK

11:30am-12:30pm

• Disorders of Peripheral Nerves
  – Peripheral Mono & Poly-Neuropathies
  – Complex regional pain syndrome
• Dementias & Delirium
• Syncope
• Concussion & Post-Concussion Syndrome
• Altered Level of Consciousness
• Movement Disorders
  – Essential tremor
  – Huntington disease
  – Parkinson disease
• Tourette Syndrome
• Infectious Disorders
  – Encephalitis
  – Meningitis
• Headaches
  – Cluster headache
  – Migraine
  – Tension headache
• Questions
Approach to the Patient with Neurological Complaints

Where is the lesion(s) in the nervous system?

• History
• Physical Examination
• Diagnostic Tests
• Treatment
• Follow-Up
Anatomy & Physiology of the Neurological System: The Neuron

http://www.web-books.com/eLibrary/Medicine/Physiology/Nervous/Nervous.htm   Accessed 07/26/10
Anatomy & Physiology of the Neurological System: Functional Organization

**Functional Organization of the Nervous System**

- **Sensory (afferent) division**
  - Transmits information from periphery to the CNS
  - Contains receptors

- **Motor (efferent) division**
  - Transmits information from CNS to the rest of the body
  - Sends motor information to effectors

**Somatic sensory**
- Receives sensory information from skin, fascia, joints, skeletal muscles, special senses

**Visceral sensory**
- Receives sensory information from viscera

**Somatic motor**
- “Voluntary” nervous system: innervates skeletal muscle

**Autonomic motor**
- “Involuntary” nervous system: innervates cardiac muscle, smooth muscle, glands

Anatomy & Physiology of the Neurological System: Functional Organization

Motor

Autonomic

Sensory

Anatomy & Physiology of the Neurological System: Brain

Anatomy & Physiology of the Neurological System:
CNS Pathways

MOTOR

SENSORY

Image References: Bates’ Guide to Physical Examination and History Taking
Anatomy & Physiology of the Neurological System: Junction of the CNS and PNS

Transverse section of thoracic spinal cord
Central nervous system

Brain

Spinal cord

Peripheral nervous system

Peripheral nerve
The Neurologic Evaluation: History

• Symptoms
  • Acute and/or Chronic
  • Involvement of motor, including autonomic, and sensory systems

• Clinical Course

• Aggravating & Palliative Factors

• Lifestyle

• PMHx, PSHx, SHx, FHx

• Medications & Allergies

• Thorough ROS, including psychiatric symptoms

• Baseline Level of Function
The Neurologic Evaluation:
Physical Examination

1. Mental Status Examination
   • Level of Consciousness, Memory, Orientation, Perceptions, Though Processes, Thought Content, Insight, Judgment, Affect, Mood, Language, Higher Cognitive Functions

2. Cranial Nerves
   • I-XII (next slide)

3. Motor
   • Body Position, Involuntary Movements, Muscle Bulk, Tone, Strength

4. Sensory
   • Pain & Temperature, Position & Vibration, Light Touch, Discriminative

5. Reflexes
   • Deep Tendon Reflexes (DTRs), Cutaneous Stimulation [Abdominal, Plantar]

6. Coordination
   • Rapid Alternating Movements, Point-to-Point Movements, Stance, Gait
The Neurologic Evaluation: Cranial Nerves

I: **Olfactory**: Olfaction
II: **Optic**: Visual Acuity & Fields, Pupillary Light Reflex
III: **Oculomotor**: Pupillary Constriction, Extraocular Movements (EOMs)
IV: **Trochlear**: Infero-Lateral EOM
V: **Trigeminal**: Mastication, Facial Sensation, Corneal Reflex
VI: **Abducens**: Lateral EOM

• VII: **Facial**: Facial Movements, Corneal Reflex
• VIII: **Vestibulocochlear**: Hearing & Balance
• IX: **Glossopharyngeal**: Palate Movement & Speech
• X: **Vagus**: Parasympathetic
• XI: **Accessory**: Shoulder Movement
• XII: **Hypoglossal**: Tongue Movement
## The Neurologic Evaluation: Diagnostic Tests

### Central Nervous System
- Computed Tomography (CT)
- CT Angiogram (CTA)
- Magnetic Resonance Imaging (MRI)
- MR Angiogram (MRA)
- Cerebral Arteriogram
- Electroencephalogram (EEG)

### Peripheral Nervous System
- Electromyogram (EMG)
- Nerve Conduction Study (NCS)

### PNS & CNS
- Cerebrospinal Fluid (CSF)
- Evoked Potential Studies (EPS)
- Laboratory Tests
- Biopsy
Where is the lesion(s) in the nervous system?
Cerebrovascular Disease

Ischemic Stroke

• Epidemiology
  – 3rd most common cause of death in the developed world
  – Overall Prevalence: 794/100,000
  – Multiple risk factors

• Pathophysiology
  – **Intrinsic**: thrombosis, atherosclerosis, lipohyalinosis, inflammation, amyloid deposition, arterial dissection, developmental malformation, aneurysmal dilatation, or venous thrombosis
  – **Extrinsic**: embolism, hypoperfusion, hemorrhage
Cerebrovascular Disease

Transient Ischemic Attack (TIA)

- **Definition**
  - Transient episode of neurologic dysfunction caused by focal ischemia without acute infarction (AHA/ASA 2009)

- **Pathophysiology**
  - Large artery low-flow
  - Embolic
  - Lacunar

- **Clinical Features**
  - Focal neurological impairment with anterior or posterior circulation features; Temporary
  - DDx: Ischemic Stroke, Seizure, Migraine Aura, Syncope, Hypoglycemia
  - ABCD² may identify high risk patients, need for hospitalization

- **Evaluation**
  - Complete within 24 hours
  - Labs: CBC, FLP, BMP with Glucose, PT/PTT, ESR
  - CT; MRI w/ diffusion; Angiogram
  - Carotid Duplex U/S
  - Echocardiogram (TTE/TEE), EKG

- **Treatment**
  - Antiplatelet; Anticoagulation if cardiac thrombus, a-fib
  - Carotid endarterectomy (70-99% Stenosis)
  - Risk Factor Reduction

- **Prognosis**
  - 4-10% have ischemic stroke within 48 hours
Cerebrovascular Disease
Ischemic Stroke

• Pathophysiology
  • Cerebral Infarction
  • Thrombotic (2/3), Embolic (1/3)
  • Less commonly systemic hypoperfusion, venous occlusion

• Clinical Features
  • Focal neurological impairment with anterior or posterior circulation features; Persistent
  • DDx: TIA, ICH, SAH, Seizure

• Evaluation
  • Hospitalization; ABCs; O2 Sat
  • Labs: CBC, FLP, BMP with Glucose, PT/PTT, ESR, Cardiac Enz
  • CT; MRI; Angiogram
  • Carotid Duplex U/S
  • Echocardiogram (TTE/TEE), EKG

• Treatment
  • ABCs; Maintain BP, fluid volume, normoglycemia
  • Thrombolysis (3.0 or 4.5 hr) with alteplase (Rt-PA)
  • Antiplatelet Therapy w/in 48h, unless Rt-PA then after 24h
  • Early anticoagulation if cardiac thrombus, afib; consider bleeding risk
  • Carotid endarterectomy (70%-99%)
  • DVT Prophylaxis
  • Rehab (PT, OT, ST)

• Prognosis
  • Highly variable
  • The prognosis for recovery is better in children than in older adults
Cerebrovascular Disease

Prevention

• Large Vessel Disease
  – **Internal Carotid Artery Stenosis**: Endarterectomy > Stenting
  – **Extracranial Vertebral Artery Stenosis**: Rx, Risk Factor Reduction; Efficacy of surgical intervention unknown
  – **Vascular Dissection**: Anticoagulation vs. Antiplatelet

• Cardiogenic Source of Embolism
  – **Atrial Fibrillation**: anticoagulation (target INR 2.5)
  – **Thrombus**: anticoagulation (INR 2-3 for at least 3 months)

• Blood Disorders
  – **Antiphospholipid Antibody Syndrome**: Antiplatelet
  – **Thrombophilia**: Antiplatelet or Anticoagulation

• Risk Factor Reduction: Primary & Secondary Prevention
  – BP Control; Tobacco Cessation; Weight Management; Normalize Cholesterol; Glycemic Control for DM and Metabolic Syndrome; Minimize ETOH Consumption
  – **Female-Specific (AHA/ASA 2014)**: Pregnancy, Preeclampsia, Gestational DM, OCPs, Post-Menopausal Hormone Use, Changes in Hormone Status
Cerebrovascular Disease

Secondary Prevention

• Cardiogenic Source of Embolism
  – Anticoagulants more effective than Antiplatelets
    • Vitamin K Antagonist: warfarin PO Daily per INR
    • Direct Thrombin Inhibitor: dabigatran 110mg or 150mg PO Twice Daily
    • Factor Xa Inhibitor: rivaroxaban 20mg PO Daily
      apixaban 5mg PO Twice Daily

  – Duration
    • Atrial Fibrillation: longstanding
    • Thrombus: at least 3 months
Cerebrovascular Disease

Hemorrhagic Stroke

• Two Types
  – Intracerebral & Subarachnoid Hemorrhage
  – Each Accounts for 10% of all stroke types

• Epidemiology
  – ICH: Overall Prevalence: 16-33/100,000
  – SAH d/t Aneurysm: Overall Prevalence: 3-25/100,000
  – Majority caused by HTN, amyloid angiopathy, ruptured saccular aneurysm, and vascular malformation

• Risk Factors
  – Tobacco Use, HTN, older age, high alcohol intake, black ethnicity, lower cholesterol (total and LDL), lower triglycerides; also anticoagulation
Cerebrovascular Disease
Intracerebral Hemorrhage

• Pathophysiology
  • Bleeding directly into brain parenchyma; Increased ICP
  • Common Causes: hypertensive vasculopathy, trauma, bleeding diathesis, amyloid angiopathy, illicit drugs, vascular malformation
  • Risks: Adv. Age, HTN, AntiThrombotic Rx

• Clinical Features
  • Gradual onset over minutes to hours
  • Focal neurologic impairment
  • Eventual headache, N/V
  • Decreased LOC if elevated intracranial pressure
  • Seizures in 5-30%

• Evaluation
  • Non-Contrast CT of Head to identify ICH
  • In patients without HTN or known cause, consider MRI, CTA/MRA

• Treatment
  • Aggressive, Full Care for 24hrs
  • Goal: contain & limit bleeding; identify and treat cause
  • BP and ICP Control
    – HOB 30 degrees, sedation, analgesia
    – Inv: Osmotic diuresis, Vent. Cath, neuromuscular blockade, surgery
  • Long-term rehab

• Prognosis
  • Mortality Rate: 35-52% at 30 days
Cerebrovascular Disease

Subarachnoid Hemorrhage

• Pathophysiology
  • Bleeding into CSF under arterial pressure leads to increased intracranial pressure
  • Two most common causes: arterial aneurysms (80-85%), vascular malformations

• Clinical Features
  • Sudden, maximal at onset
  • “Worst headache of my life”
  • N/V, mental status change, elevated BP
  • Meningismus, Vitreous Hemorrhage, LOC, seizure
  • “Sentinel” Headache in 30% with minor bleed that precedes major bleed

• Evaluation
  • Emergent CT
  • CSF Analysis if CT negative
  • Cerebral Angiogram, CTA, MRI/A
  • CBC, BMP, Coag, Toxicology

• Treatment
  • Aggressive, Full Care
  • Goals: Identify & treat cause to prevent re-bleeding; manage complications
  • ICP & BP Control
    – Ventriculostomy for elevated ICP, acute hydrocephalus
  • Surgical – clip or coil aneurysm
  • Nimodipine improves outcomes

• Prognosis
  • Rebleeding common w/in 24h
  • Mortality Rate: 50% w/in 30d
Multiple Sclerosis

• General Information
  • Relapsing Remitting, Primary Progressive, or Secondary Progressive
  • 18-45yo, F > M

• Pathophysiology
  • T-cell mediated multifocal inflammation and demyelination; then gliosis
  • Possible viral precipitant
  • Genetic factors

• Clinical Features
  • Episodic focal neurological impairment involving multiple CNS regions with or without complete recovery
  • Separated by space & time
  • Common presentations: optic neuritis, transverse myelitis

• Evaluation
  • MRI with Contrast
  • CSF: protein, IgG, Oligoclonal Bands, Myelin Basic Protein
  • Evoked Potential Studies

• Treatment
  • Acute Inflammation: high dose IV corticosteroids
  • Disease-Modifying Therapies: interferons; glatiramer acetate; natalizumab (risk progressive multifocal leukoencephalopathy), fingolimod, teriflunomide, dimethyl fumarate

• Prognosis
  • Variable comorbid problems: fatigue, mood, cognition, pain, spasticity, gait impairment, bladder dysfunction
Guillain-Barre Syndrome

• General Information
  • Acute Inflammatory Demyelinating Polyneuropathy (AIDP) Variant

• Pathophysiology
  • Autoimmune-mediated demyelination or axon injury → dysfunction of peripheral nerves
  • Often follows infection, immunization, surgery, BMT

• Clinical Features
  • Acute (hrs to days); Monophasic
  • Progressive, Symmetrical, Motor > Sensory Impairment
  • Distal → Proximal
  • Decreased or Absent DTRs
  • Respiratory Impairment

• Evaluation
  • NCS: slow nerve conduction; denervation, axon loss
  • CSF: elevated protein

• Treatment
  • Inpatient Management
  • Acute: Plasmapheresis, IV Ig
  • Monitor Respiratory Status
  • Long-Term: PT, OT, ST

• Prognosis
  • Can be life-threatening if respiratory or swallowing muscles are affected
  • Ventilatory Support (30%)
  • Autonomic Dysfx (70%)
  • Slow, often incomplete recovery; chronic type
Myasthenia Gravis

- **General Information**
  - Generalized and Ocular Types
  - More common in young women and older men

- **Pathophysiology**
  - Autoimmune destruction of acetylcholine receptors (AChR) on the surface of skeletal muscles

- **Clinical Features**
  - Insidious onset; Fluctuating
  - Muscle weakness, fatigability (CNs, Extremities, Respiration)
  - Symptoms improve with rest
  - Infection may exacerbate symptoms
  - Normal Sensation, No DTR Change
  - Myasthenic Crisis
  - Ocular Type: ptosis, EOMs Weak

- **Evaluation**
  - Edrophonium (Tensilon) Test
  - Chest CT: R/O Thymoma
  - EMG/NCS with Rep Nr Stim: slow muscle response
  - Serum AChR Ab; Serum MuSK Ab; TFTs (Ocular Type)

- **Treatment**
  - Cholinesterase inhibition: pyridostigmine
  - Refractory Sx: Immunotherapy
  - Rapid Tx: IVIG or Plasmapheresis
  - Thymectomy if hyperplasia in AChR Ab positive MG

- **Prognosis**
  - Maximal extent at 3yrs in majority of patient
  - Course may be progressive or relapsing-remitting
Cerebral Palsy

• General Information
  • 2-4/100,000 children

• Pathophysiology
  • Multifactorial
  • Cerebral injury before, during, or after birth; Prenatal Risk Factors
  • Types: Spastic, Dyskinetic, Ataxia

• Clinical Features
  • Chronic, non-progressive impairment of muscle tone, strength, coordination, or movements
  • Clinical expression may change over time
  • Spasticity (75%); Seizure Disorder (45%); Mental Retardation; Specific Learning Disabilities

• Evaluation
  • Serial physical examinations
  • Monitor if prenatal risk factors
  • Classify type
  • MRI Brain for etiology, prognosis
  • Metabolic and Genetic testing
  • EEG if seizure suspected

• Treatment
  • Supportive, Multidisciplinary Team
  • Goal: Maximize Function
  • Rx: Spasticity, Seizures
  • Prev: MagSulf in PreTerm Labor

• Prognosis
  • Variable
  • Comorbidities: poor growth, orthopedic problems, osteopenia, urinary disorders, hearing, vision, cognition
Seizure Disorders

• General Information
  • Prevalence: 0.5-1%

• Pathophysiology
  • Not fully understood
  • Epileptic Seizure: Inherent, recurrent abnormal paroxysmal neuronal discharges
  • Secondary: Provoked
  • Non-Epileptic: Psychogenic

• Clinical Features
  • Generalized: convulsive or non-convulsive
  • Focal: simple(partial) or complex
  • Status epilepticus = medical emergency
    – Tx: benzodiazepam
  • Post-Ictal State
  • Secondary report from witness

• Evaluation
  • Determine if epileptic event
  • EEG
  • Neuroimaging (MRI)
  • Labs for metabolic and toxic causes; Prolactin

• Treatment
  • Epilepsy: Antiepileptic Drugs (AEDs)
    • Mono→Mono→Poly-therapy
  • Women of Child-Bearing Age
    – AEDs may affect OCPs
    – Folate Supplementation
    – Caution with valproate, carbamazepine
  • Manage secondary causes
  • Avoid Provoking Factors

• Prognosis
  • Drug Resistant Epilepsy: 20-40%
  • Driving Restrictions
Disorders of the Peripheral Nerves

Mono-Neuropathies

- Carpal Tunnel Syndrome
- Ulnar Neuropathy
- Radial Neuropathy
- Meralgia Paresthetica
- Femoral Neuropathy
- Sciatic Nerve Palsy
- Peroneal Nerve Palsy
- Tibial Neuropathy
- Cranial Nerve VII Palsy

Pathophysiology
- Most Common: Compression

Clinical Features
- Focal Sensory and/or Motor

Evaluation
- Occupational/Activity History
- Special Physical Exam Tests
- EMG/NCS

Treatment
- Conservative: modify activities, brace, PT/OT, Anti-Inflammatories
- Invasive: Surgery, Steroid Injections
Disorders of the Peripheral Nerves

Poly-Neuropathies

• Hereditary
  • Charcot Marie Tooth Disease
• Endocrine
  • Diabetes, Uremia, Alcohol, B12 Deficiency
• Infectious
  • HIV/AIDS, Leprosy, Lyme Disease
• Inflammatory
  • Sarcoidosis, Polyarteritis, Rheumatoid Arthritis
• Toxic
  • Industrial Agents, Pesticides, Heavy Metals, Medications
• Paraneoplastic Syndromes
• Neuropathy Associated with Critical Illness

• Clinical Features
  • Motor, Sensory, Autonomic
  • Proximal or Distal
  • Acute or Chronic

• Evaluation
  • Decreased DTRs
  • Select Labs: CMP, HgA1C, B12, Toxicology, Paraneoplastic Panel
  • EMG/NCS

• Treatment
  • Direct at cause
  • Symptomatic to support motor activity, sensory discomfort, and autonomic function
  • Refer when indicated

• Prognosis
  • Variable depending on etiology
Disorders of the Peripheral Nerves

Complex Regional Pain Syndrome

• General
  • Type 1: un-definable nerve lesion, AKA reflex sympathetic dystrophy, 90% of cases
  • Type 2: definable nerve lesion

• Pathophysiology
  • Unclear; may involve reflex arc
  • Frequently begins following an injury, surgery, or vascular event such as a stroke

• Clinical Features
  • Involve specific body region, usually the extremities
  • Characterized by pain, swelling, limited range of motion, vasomotor instability, skin changes, and patchy bone demineralization.
  • 3 Stages: Early, Subacute, Chronic

• Evaluation
  • Clinical Diagnosis
  • Autonomic Testing
    – Resting sweat output (RSO), resting skin temperature (RST), and quantitative sudomotor axon reflex test (QSART)
  • Consider bone scintigraphy, plain radiographs, or MRI

• Treatment
  • Prevention: early mobilization
  • Prevention: Vitamin C supplementation for fractures
  • Pain management
  • Pharmacologic and invasive procedures

• Prognosis
  • Variable
Dementias

• General Information
  • Alzheimer (AD): 60-80%
  • Lewy Body; Vascular Type; Mixed Type
  • Diagnostic Criteria: DSM IV TR

• Pathophysiology
  • Unknown; Genetic & Environmental

• Clinical Features
  • AD: Intellectual impairment with compromise in at least two of the following: language, memory, visuospatial skills, emotional behavior, personality, and cognition
  • Lewy Body Dementia: impaired cognition with Parkinsonian features
  • Vascular: forgetfulness, attention maintained
  • DDx: Parkinson Dementia, Alcohol-Related Dementia, Frontotemporal Dementia, Cerebrovascular Disease, Delirium, Depression

• Evaluation
  • History, Physical Exam, Secondary Reports, Screen with MMSE (<24)
  • Neuropsychological evaluation
  • TSH, B12 deficiency, CBC, CMP, heavy metals, drug/alcohol screen; consider imaging

• Treatment
  • All Types: acetylcholinesterase inhibitors - donepezil, rivastigmine, and galantamine
  • AD: N-methyl-D-aspartic acid (NMDA) receptor antagonist
  • Lewy Body: dopamine agonists
  • Vascular: control BP, metabolic abnormalities
  • Supervision & Safety
  • Behavioral Management
  • Caregiver support

• Prognosis
  • Variable progression
Delirium

• General Information
  • AKA: acute confusional state, encephalopathy

• Pathophysiology
  • Poorly understood
  • Multiple risks & precipitants
  • May be caused by medical condition, medicine, or intoxication; if not, NOS

• Clinical Features
  DSM-IV Criteria
  • Disturbance of consciousness with reduce ability to focus, sustain, or shift attention
  • A change in cognition or new perceptual disturbance
  • Sx develop over hours to days, tend to fluctuate
  • Atypical Symptoms: focal or lateralizing deficits

• Evaluation
  • History & Physical Exam
  • Confusion Assessment Method (CAM)
  • Medication review, electrolytes, infection, intoxication, withdrawal, metabolic, low perfusion, postoperative
  • Select tests based on DDx

• Treatment
  • Direct at the cause; Safety measures; Close follow-up
  • Prevention: minimize risk factors, environmental modification, orientation protocols, sensory aids, no restraints

• Prognosis
  • May persist for days to months
  • Increased mortality
Syncope

• General Information
• Pathophysiology
  • DDx: arrhythmia, aortic stenosis, carotid sinus hypersensitivity, MI, hypoglycemia, orthostatic hypotension, postprandial hypotension, psychogenic, PE, vagal faint, TIA, seizure

• Clinical Features
  • Sudden, transient loss of consciousness (LOC) with loss of postural tone; not due to trauma; rapid spontaneous recovery
  • Differentiate from vertigo and pre-syncope
  • Exertion
  • Witness report helpful

• Evaluation
  • History & Physical Examination; PMHx CAD, CVD
  • Stratify risk for sudden cardiac death
  • EKG
  • Consider: Ambulatory Cardiac Monitoring, Echocardiogram, Tilt Table Test, Electrophysiologic Studies, CT or MRI Brain

• Treatment
  • Direct at the cause
  • Consider driving restrictions

• Prognosis
  • Recurrence is variable based on cause and treatment success
Concussion

• General Information
  • AKA Mild traumatic brain injury (TBI)
  • Annual Incidence Sports-Related Concussion (US): 1.6-3.8 million

• Pathophysiology
  • Due to contact and/or acceleration/deceleration force
  • Coup/Contracoup cortical contusions; axonal rupture

• Clinical Features
  • Concussion: trauma-induced change in mental status +/- loss of consciousness
  • Early Sx: Amnesia, HA, <awareness, dizziness, N/V
  • Late: mood, cognition, sleep, sensitivity to light and noise
  • Seizures (5%)

• Evaluation
  • Medical or Trained Professional
  • Standardized Assessment of Concussion (SAC)
  • Monitor for Complicated Concussion (evolving subdural hemorrhage)

• Treatment
  • Identification of immediate neurologic emergencies and high-risk individuals for second impact syndrome
  • Manage neurologic sequelae
  • Prevention of cumulative and chronic brain injury (i.e. limit repeated injury)
  • Monitor for 24 hours; Hospitalization for GCS <15, abnormal CT, Seizures, or predisposition for bleeding

• Prognosis
  • Second Impact Syndrome: diffuse cerebral edema that occurs after 2nd concussion; rare and controversial
  • Return to Play: graduated approach
  • Post-Concussion Syndrome
Post-Concussion Syndrome

• General Information
  • May occur following any type of TBI; 30-80% of cases
  • More common in females and elderly

• Pathophysiology
  • Theories: structural, biochemical, psychogenic

• Clinical Features
  • Headache, dizziness, fatigue, neuropsychiatric Sx, cognitive impairment, insomnia, anxiety, irritability, noise sensitivity

• Evaluation
  • Clinical Diagnosis
  • Judicious testing, neuropsych
  • MRI to exclude other causes
  • Referral for Prominent Symptoms, Psychiatric D/O

• Treatment
  • Individualized & Symptomatic
  • Education & Reassurance

• Prognosis
  • Symptoms most severe: 7-10 d
  • Majority subclinical: 30 d
  • Vast majority recover: 3 mos
  • 10-15% have persistent PCS
Altered Level of Consciousness

• General Information
  • Alert ←→ Coma Spectrum
  • Coma: “unarousable unresponsivness”

• Pathophysiology
  • Impairment of the Reticular Activating System (RAS)
  • Common Etiologies: trauma, CVA, intoxication, metabolic, infection

• Clinical Features
  • Abnormal vital signs, ventilatory pattern, trauma
  • Decreased LOC, Motor Responses, Cranial Nerve Reflexes

• Evaluation
  • Glasgow Coma Scale (GCS)
  • Detailed Neuro Exam
  • Labs: CBC, CMP, ABG, aPTT, PT, Toxin Screen
  • Neuroimaging, CSF, EEG, EKG

• Treatment
  • Airway, Breathing, Circulation
  • Manage cause
  • Close Monitoring

• Prognosis
  • Dependent upon cause, severity of brain injury
  • GCS
  • FOUR Score
Movement Disorders
Essential Tremor

• General Information
  • Most common cause of tremor: 5% worldwide
  • 50% of Cases are Familial, Autosomal Dominant

• Pathophysiology
  • Unclear; Genetic Factors
  • Possible involvement of brainstem, cerebellum

• Clinical Features
  • Longstanding, Progressive
  • Chronic Bilateral Action Tremor; Absent at Rest
  • To-and-Fro Tremor
  • UE > LE; Head Titubation; Speech Impairment
  • No other deficits; no dystonia

• Evaluation
  • Clinical Diagnosis
  • Assess for Family History of Tremor
  • Evaluate for neurologic deficits, Parkisonian Sx
  • Beneficial response to alcohol

• Treatment
  • AAN Guidelines [2011]
  • 1st Line: propanolol or primidone
  • 2nd Line: Beta Blockers, gabapentin, topiramate
  • Refractory: Botox, Surgery
  • Alcohol: discouraged

• Prognosis
  • Variable
Movement Disorders
Huntington’s Disease

- General Information
  - Rare: 5-8/100k (U.S., Europe)

- Pathophysiology
  - Progressive Neurodegeneration
  - Trinucleotide (CAG) expansion in the Huntington gene on chromosome 4p
  - Autosomal-Dominant

- Clinical Features
  - Choreiform Movements & Dystonia
  - Psychiatric & Behavior Changes
  - Dementia
  - Slowly Progressive

- Evaluation
  - Clinical Diagnosis
  - Family History
  - Genetic Testing
  - Neuroimaging: late stage caudate atrophy

- Treatment
  - Supportive, Interdisciplinary Care; No Cure
  - Movement: tetrabenazine; otherwise atypical then typical neuroleptics
  - Psychosis: neuroleptics

- Prognosis
  - Usually fatal within 15-20 years
  - Family Genetic Testing
Movement Disorders
Parkinson’s Disease

- **General Information**
  - Mean Onset: 70.5 yo
  - Prevalence: 0.3% (general pop.); 3% population over > 60 yo

- **Pathophysiology**
  - Degeneration substantia nigra
  - Decrease dopamine, imbalance of acetylcholine

- **Clinical Features**
  - Progressive Symptoms
  - Cardinal Features: Resting Tremor, Bradykinesia, Rigidity
  - Also Postural Instability, Shuffling Gait, Masked Facies, Stooped Posture, Micrographia
  - Non-Motor: Depression, Fatigue, Cognitive Impairment, Psychosis

- **Evaluation**
  - Clinical Diagnosis
  - Sx respond to dopamine
  - Rule out secondary causes (drug induced)

- **Treatment**
  - Dopaminergic: levodopa/carbidopa, bromocriptine
  - Anticholinergic: amantadine, benztropine
  - Adjuncts: COMT, MAO B Inhibitor; Deep Brain Stim
  - PT; Psych; Family Support

- **Prognosis**
  - Variable Progression
Tourette Syndrome

• General Information
  • Disorder manifested by motor and phonic tics
  • 2-8/1,000 (worldwide)
  • Onset: Childhood (2-15yo)

• Pathophysiology
  • Genetic predisposition
  • CNS dis-inhibition of the motor and limbic system

• Clinical Features
  • Tics: sudden, brief, intermittent movements (motor) or utterances (vocal or phonic)
  • Simple or Complex
  • Comorbidities: ADHD, OCD

• Evaluation
  • Clinical Diagnosis
  • Other behavioral disorders
  • Family History

• Treatment
  • Education for patient, family, teachers, peers, etc.
  • Rx when function impaired
    – Dopamine Agonists
    – Botulinum toxin injection
  • Habit Reversal Training
  • Treat Comorbidities

• Prognosis
  • 50% of cases resolve by age 18
  • Severity diminishes during adulthood
CNS Infection

Bacterial Meningitis

- **General Information**
  - Strep pneumoniae, Neisseria meningitidis, group B streptococci (infants), ↓Hflu since ↑HIB Immunization
  - Medical Emergency
  - Prevention: Immunization against N. meningitidis, S. pneumoniae

- **Pathophysiology**
  - Inflammation, Cytokine mediated
  - ↑ Intracranial Pressure (ICP)
  - Tissue Necrosis

- **Clinical Features**
  - Triad: Fever, Nuchal Rigidity, Mental Status Change
  - Headache – generalized, severe

- **Evaluation**
  - CT: R/O Space-Occupying Lesion if risk factors present
  - CSF: ↑ICP, ↑WBC (1-10k), ↑Prot, ↓Glucose, turbid-purulent, Gram Stain & Culture
  - Blood Cx: Positive in 50-90%

- **Treatment**
  - Empiric Antibiotics after LP
  - Dexamethasone to reduce neurologic complications
  - Pathogen-Directed Antibiotics

- **Prognosis**
  - Mortality Rate 100% w/o Tx
  - Monitor for Response and Complications
CNS Infection
Viral Meningitis/Encephalitis

• General Information
  • AKA “Aseptic”, Cx Negative
  • ↑ Incidence Summer, Fall
  • Coxsackievirus A/B, echoviruses, mumps

• Pathophysiology
  • Inflammation from virus or from perimeningeal area (ears, sinuses)
  • Risk Factors: travel, ticks, STIs

• Clinical Features
  • Meningitis: headache, fever, nausea or vomiting, malaise, photophobia, and meningismus
  • Encephalitis: mental status change, motor/sensorhy deficits, behavior change
  • Seizures can occur with either

• Evaluation
  • History to ID possible exposures
  • CT: R/O Space-Occupying Lesion
  • CSF: ↑WBC (1k); Prot, Glucose, & ICP WNL; clear; Gram Stain & Culture Neg
  • HSV PCR; CSF and serum IgM Ab for West Nile Virus
  • Rule bacterial cause

• Treatment
  • Acyclovir if + HSV, encephalitis
  • Symptomatic
  • Consider Empiric ABX in elderly, immunocompromised, or if on ABX

• Prognosis
  • Benign and self-limited
Headache Disorders

Tension Type Headache

• General Information
  • Most common type of headache
  • Females > Males

• Pathophysiology
  • Unknown, though likely multifactorial; including genetic
  • Abnormal neuronal sensitivity in CNS misinterprets normal stimuli as noxious

• Clinical Features
  • Mild to moderate intensity, bilateral, nonthrobning headache without other associated features (phonophobia, nausea, vomiting) or aggravation with physical activity
  • Pericranial muscle tenderness
  • Triggers: psychosocial stress, migraine

• Evaluation
    • Infrequent Episodic TTH: HA 1d/mo
    • Frequent Episodic TTH: HA 1-14 d/mo
    • Chronic TTH: HA 15 or more d/mo
  – Neuroimaging for HA with other deficits, atypical features

• Treatment
  • Abortive: ibuprofen, naproxen, acetaminophen; ketorolac IM; adjunct with caffeine
    – Avoid opiates, butalbital
    – Avoid Rx Overuse Headache
  • Preventive: amitriptyline, SSRIs, anticonvulsants; behavioral including stress mgt, EMG biofeedback, PT, acupuncture

• Prognosis
  • Variable; Avoid medication overuse headache
Headache Disorders
Migraine Headache

• General Information
  • Prevalence: 12%; F>M
  • Migraine without Aura (75%)

• Pathophysiology
  • Multi-factorial; genetics
  • Common Triggers: Stress, Hormones, Not eating, Weather, Sleep Disturbance

• Clinical Features
  • Prodrome: affective or vegetative symptoms
  • Aura: focal neurologic Sx
  • Headache: unilateral, “throbbing”, +/- nausea, vomiting, phonophobia, photophobia
  • Postdrome: exhaustion

• Evaluation
  • IHS Diagnostic Criteria for w/ Aura and w/o Aura
  • Imaging if atypical symptoms, focal deficits, immunocompromised

• Treatment
  • Abortive: NSAIDs, acetaminophen, triptans, DHE, anti-emetics; prompt Tx
  • Prophylaxis if >4 HA/Month, HA > 12 hrs, HA → disability
  • Prophylactic: BBs, CCBs, ACE/ARBs, TCAs, Anticonvulsants; Behavioral Tx

• Prognosis
  • Variable
  • Education; Avoid Triggers
Headache Disorders
Cluster Headache

• General Information
  • Most common type of trigeminal autonomic cephalalgias
  • Prevalence: <1%;
  • M:F Ratio - 4.3 :1

• Pathophysiology
  • Unclear
  • Genetic factors

• Clinical Features
  • Bouts & Remissions
  • Short-lasting (15-180 minutes)
  • Unilateral: Periorbital, Supraorbital, Temporal
  • Severe Pain
  • Autonomic Symptoms

• Evaluation
  • Clinical Diagnosis
  • IHS Diagnostic Criteria for episodic & chronic types
  • Imaging if mass lesion suspected

• Treatment
  • Abortive: oxygen, if no effect then triptans
  • Prophylactic: begin at diagnosis; verapamil, low dose prednisone

• Prognosis
  • Recurrence 80% at 15 years after Diagnosis
  • Variable
Questions ?


UpToDate, Basow, DS (Ed), UpToDate, Waltham, MA, 2014.
Post-Test Question 1

• Which of the following types of involuntary movements is most suggestive of Parkinson’s Disease?

a) Unilateral resting tremor
b) Bilateral action tremor
c) Clonic jerking movements
d) Choreiform movements
Post-Test Question 2

• Imaging of the brain is most strongly indicated for patients who present with acute headache if there is:
  a) Unilateral pain
  b) Focal deficits on neurologic examination
  c) Phonophobia or photophobia
  d) Remote history of head trauma
Post-Test Question 3

- A 72-year old patient presents with complaints of “the worst headache of my life.” Review of systems is positive for nausea. Physical exam is remarkable for elevated blood pressure and lethargy. What is the most likely diagnosis?
  a) Transient ischemic attack
  b) Acute ischemic stroke
  c) Intracerebral hemorrhage
  d) Subarachnoid hemorrhage