Neuromuscular Pathology
PTA 103
Introduction to Clinical Practice 2

Why do PTAs need to understand pathology?

- Communication of dysfunction and observations depends on a mutually understood vocabulary between health care providers
- Increased ability to understand terms used in a PT evaluation report
- Understanding disease presentation and progression increases relevance of tests, measures, and interventions, area of concern in discharge planning, equipment management, communication, and home safety

Nervous System Pathology

- Sources of dysfunction include
  - Impaired circulation (embolic or hemorrhagic)
  - Disease of brain cells (degenerative)
  - Disease at the neuromuscular junction
  - Trauma (traumatic brain injury, spinal cord injury, peripheral nerve injury)
  - Idiopathic
Nervous System Pathology

Upper Motor Neuron (UMN) disease
- Lesions within the descending motor tracts
- Includes the cerebral cortex, internal capsule, brainstem, or spinal cord
- Symptoms include:
  - Weakness of involved muscles
  - Hypertonicity
  - Hyperreflexia
  - Disuse atrophy
  - Abnormal reflexes

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Nervous System Pathology

Lower Motor Neuron Disease
- Lesion involving nerves/axons at and below the brainstem
- Symptoms include
  - Flaccidity or weakness of involved muscles
  - Decreased tone
  - Fasciculations
  - Muscle atrophy
  - Decreased or absent reflexes

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Pathology of CNS Circulation

Stroke/Cerebral Vascular Accident
- Also known as "brain attack"
- Upper Motor Neuron Dysfunction
- Types are ischemic and hemorrhagic
- Risk factors include:
  - Atherosclerosis
  - HTN
  - Vascular insufficiency
  - Diabetes
  - Cardiac disease
  - Advanced age
Pathology of CNS Circulation

Ischemic
- Hypoperfusion with oxygen results in tissue injury
- Most common cause of stroke
- Caused by cardiovascular disease, thrombosis, hemodynamic compromise (BP regulation), and vessel stenosis
- Transient Ischemic Attack (TIA) = temporary brain or brainstem ischemia lasting less than 24 hours

Hemorrhagic
- Abnormal bleeding in cerebral vessels
- Classified by their anatomical location
  - Intracerebral (ICH)
  - Meninges
    - Subarachnoid (SAH)
    - Subdural (SDH)
- Damage results from sudden disruption in blood flow and swelling
- Causes include advanced age, HTN, arteriovenous malformation (AVM), closed head injury (CHI), ruptured aneurysms and drug abuse

Differences between Ischemic and Hemorrhagic

Ischemic
- Most common
- Caused by emboli or arterial narrowing
- Damage follows vascular distribution
- Symptoms of stroke develop and worsen over time
- Warning symptoms (changes in vision, balance, cognition, speech) often precede ischemic stroke
- Impairments are somewhat predictable

Hemorrhagic
- Less common
- Caused by rupture of vessels
- Damage can extend into multiple vascular territories
- Symptoms are usually sudden
- Warning symptoms (vomiting, severe headache, impaired consciousness) often precede hemorrhagic stroke
- Impairments will vary with the individual and size of the hemorrhage
Arteriovenous Malformation (AVM)
- Disorganized collection of abnormally thin dilated blood vessels in the brain
- Directly shunts arterial blood into the venous system
- Result in increased pressure within the AVM and risk for hemorrhagic stroke
- Signs and symptoms include seizures, HA, dizziness, syncope, aphasia, motor and/or sensory deficits, c/o a “swishing noise” in the head

R CVA Impairments
- L sided paresis
- Decreased attention span
- Decreased awareness and judgement
- Memory deficits
- L hemianopsia
- L inattention
- Decreased abstract reasoning
- Emotional lability
- Impulsivity
- Decreased spatial orientation

L CVA Impairments
- R sided paresis
- R hemianopsia
- Aphasia
- Apraxia
- Decreased R and L discrimination
- Dysphagia
- Decreased initiation of tasks
- Increased frustration
- Compulsive behavior
Brainstem CVA Impairments

- Bilateral paresis
- Unstable vital signs
- Decreased consciousness
- Dysphagia

Cerebellum CVA Impairments

- Bilateral decreased coordination
- Ataxia
- Nystagmus
- Nausea
- Decreased postural control

Basilar Artery CVA

- Often leads to coma
- Bilateral cerebellar ataxia
- Decreased strength in face, tongue, and pharyngeal muscles
- May result in “locked in” syndrome: patient is alert and awake but completely paralyzed; can move eyes vertically and blink
Internal Carotid Artery
- Paralysis and/or sensory impairments of contralateral face, UEs, and LEs
- Aphasia
- Apraxia, agnosia, unilateral neglect
- Homonymous hemianopsia: similar visual loss in half of visual field

Middle Cerebral Artery
- Large ischemic stroke in the brain

[Images of brain diagrams]
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**Traumatic Brain Injury (TBI)**

- **Primary cause of death and disability in children and young adults**
- **Greater incidence in males (3:1)**
- **Child abuse accounts for the majority of TBI cases in children**
- **Primary causes of TBI in general population**
  - MVA (motor vehicle accidents)
  - Falls
  - Violence
  - Sports-related injuries

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**Traumatic Brain Injury (TBI)**

- **Brain impacts skull**
- **Secondary effects**
  - Swelling
  - Bleeding
  - Hypotension
  - Respiratory complications
  - Hypoxia
  - Neuronal damage and death (diffuse axonal injury)
  - Increase intracranial pressure (ICP)
  - Herniation of brain tissue

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**Coup**

**Contrecoup**

**Primary Impact**

**Secondary Impact**

[Image of coup and contrecoup on a brain]
Classification of Function

- **Glasgow Coma Scale**
  - Used to rate level of consciousness and correlates to severity of head injury
  - Rates patient on visual, verbal, and motor responsiveness
  - Range of score is 3 to 15

- **Rancho Los Amigos Level of Cognitive Functioning (LOCF)**
  - Describes a predictable, eight-level, cognitive and behavioral TBI recovery sequence
  - Patients may plateau in progress at any level

Classification of Tone

- Can be generally described as flaccid, hypotonic, normal, hypertonic and/or spastic
- Modified Ashworth Scale uses a numerical scale to describe neuromuscular tone

Surgical Procedures for the Brain

- Burr hole: small hole in skull for relief of pressure from hemorrhage or placement of ICP monitors
- Craniotomy: surgically opening the skull for repair of brain tissue or tumor resection
- Craniectomy: bone flap is removed to relieve pressure/fight infection (pts need to wear helmet)
- Cranioplasty: replacement of bone flap with excised bone or acrylic material
Neuromuscular Diseases

• Parkinson’s Syndrome and Disease (PS; PD)
• Multiple Sclerosis (MS)
• Guillain-Barre Syndrome (GBS)
• Myasthenia Gravis (MG)
• Amyotrophic Lateral Sclerosis (ALS)

Parkinson’s Disease

• Idiopathic neurodegenerative disorder resulting in decreased dopamine production
• Characteristics include
  – Tremor at rest; “pill-rolling”
  – Tremors increase with stress, fatigue, or at the initiation/termination of movement
  – Cogwheel rigidity
  – Jarring resistance throughout passive ROM
  – Lead pipe rigidity
  – Fixed resistance throughout passive ROM
  – Bradykinesia
  – Hypokinesia or akinesia
  – Gait impairments (festination)
  – Facial rigidity
  – Fixed trunk flexion and loss of trunk rotation

Multiple Sclerosis

• Upper Motor Neuron (UMN) disease
  – Progressive destruction of myelin sheath
  – Affects neurotransmission and scars axons
• Most common cause of severe disability in young adults (onset in 30s; higher incidence in women)
• Signs and symptoms can vary due to effects in multiple CNS regions; no specific diagnostic test is available
• 4 clinical courses of MS (progressive increase in severity and resultant disability):
  – Benign
  – Exacerbating remitting
  – Remitting progressive
  – Progressive
Multiple Sclerosis

Symptoms can include
• Fatigue
• Sensory dysfunction
• Motor symptoms
• Spasticity
• Ataxia
• Visual disturbances
• Decreased coordination
• May involve brainstem functions, resulting in changes in control of vision and speech

Guillain-Barre Syndrome

• Also called acute idiopathic polyneuritis
• Lower motor neuron demyelinating disease
• Unknown cause: may be associated with viral or bacterial infection
• Requires mechanical ventilation due to damage to myelin in nerves supplying muscles of respiration
• Recovery is prolonged (around 6 months or more)
• Can result in some permanent loss of muscle function

Guillain-Barre Syndrome

Symptoms are due to loss of the nerve to conduct a signal down the axon
Symptoms include:
• Severe motor weakness and sensory abnormalities which begins distally (toes and/or hands) and ascend into upper body
• Areflexia
• Weakness may include respiratory, brainstem and autonomic system
Myasthenia Gravis

- Chronic, progressive autoimmune disease
- Onset is gradual and progressive over 5-7 years
- Symptoms include:
  - Weakness of voluntary muscles (chewing, swallowing, speaking, facial, extraocular)
  - Progressive weakness results will include diaphragm

Amyotrophic Lateral Sclerosis (ALS)

- Also known as Lou Gehrig’s Disease
- Rapidly progressive and fatal: effects both upper and lower motor neurons
- More common in males (3:1)
- Insidious onset of asymmetrical weakness
- Additional symptoms include:
  - Muscle cramping
  - Fasciculations
  - Hyperreflexia
  - Cranial nerve dysfunction
- Sensation and cognition is intact

Spinal Cord Injury (SCI)

- Categorized as traumatic and non-traumatic
- Majority of cases are traumatic (MVA, violence)
- Higher incidence in males
- Mechanism of injury is hyperflexion-hyperextension (whiplash), compression, rotation
Spinal Cord Injury

- Can be complete (total loss) or incomplete (sparing) below level of lesion
- Named by the most distal uninvolved segment (e.g., C5 quadriplegia)
- Can result in syndromes depending on mechanism of injury
  - Anterior cord
  - Central cord
  - Posterior cord
  - Brown-Sequard
  - Cauda Equina

Spinal Surgeries

- Can be performed by an orthopedist or neurosurgeon
- Includes removal of discs, vertebral sections (lamina, foramen)
- Includes surgical stabilization for instability (fusion)
- Patients may have quadriplegia or hemiplegia depending on reason for fusion and associated spinal nerve compression
On to Interventions!

Next, we'll look at what interventions are available to help minimize impact of impairments, functional limitations, and disability.