Neurological Emergencies
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Dysfunction of Cortex/Subcortex

- Stroke
  - Acute Ischemic Stroke/TIA
  - Intracerebral Hemorrhage
  - Subarachnoid Hemorrhage
- Seizure
  - Status epilepticus

Stroke is a Vascular Event

Epidemiology

- 800,000 strokes annually
- 200,000 more TIA's
- 50% will be alive in 5 years
- Leading cause of disability
- 5 million stroke survivors
- Over $100 billion cost annually
New Definition of TIA

- Updated in 2014: a transient episode of neurological dysfunction caused by focal brain, spinal cord, or retinal ischemia, without acute infarction.

- And when imaging not available..... Sx lasting less than 24 hrs

Time is Brain quantified

<table>
<thead>
<tr>
<th>Time</th>
<th>Neurons Lost</th>
<th>Synapses Lost</th>
<th>Myelinated Fibers Lost</th>
<th>Accelerated Aging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per Stroke</td>
<td>1.2 billion</td>
<td>8.3 trillion</td>
<td>7140 km/4470 miles</td>
<td>36 years</td>
</tr>
<tr>
<td>Per Hour</td>
<td>120 million</td>
<td>830 billion</td>
<td>714 km/447 miles</td>
<td>3.6 years</td>
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<tr>
<td>Per Minute</td>
<td>1.9 million</td>
<td>14 billion</td>
<td>12 km/7.5 miles</td>
<td>3.1 weeks</td>
</tr>
<tr>
<td>Per Second</td>
<td>32,000</td>
<td>230 million</td>
<td>200 meters/218 yards</td>
<td>8.7 hours</td>
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Saver, J Stroke. 2006;37:263-266

TIA

- 25% dead in one year
- 17% followed by stroke
- 15% of strokes preceded by a TIA
- Greater risk for stroke after TIA if:
  - >60 DM
  - Symptoms > 10 minutes
  - Experience weakness or communication deficits

**Signs/Symptoms of Stroke**

**"The Suddens"**

- Sudden Onset of:
  - Weakness or numbness of the face, arm, or leg especially on one side of the body
  - Confusion or trouble speaking or understanding
  - Trouble walking, dizziness, or loss of balance or coordination
  - Trouble seeing in one or both eyes
  - Severe headache with no known cause
**Options for Patients Experiencing an Ischemic Stroke**

- **Endovascular Clot Removal**
  - Mechanical disruption or removal of the clot using standard endovascular approaches

- **IV tPA**
  - Gold-standard in ischemic stroke care. Drug is designed to break apart the clot.

- **Medical Management**
  - Monitor vitals and provide secondary stroke prevention.

- **Bridging Therapy**
  - Tissue Plasminogen Activator for Acute Ischemic Stroke
  - The National Institute of Neurological Disorders; Stroke rtPA Stroke Study Group (NEJM 1995;333:1581-7)

  - Global Odds Ratio for Favorable Outcome* = 1.7 [1.2 – 2.6] p = .008
  - (Global Comparison of All Scales Combined)

  *complete or nearly complete neurological recovery at 3 months

Additional Excluded If:
- >80 years old
- On anticoagulation
- Prior stroke plus DM
- Severe Stroke (NIHSS >25)

Approved by:
- (Class I Recommendation, Level of Evidence B)

35-40% of Ischemic Strokes are Considered "Large Vessel"

- Blockages in the:
  - Internal Carotid Artery (ICA)
  - Middle Cerebral Artery (MCA)
  - Vertebral / Basilar Artery

- Patient prognosis with these types of stroke is poor

<table>
<thead>
<tr>
<th>Vessel</th>
<th>Mortality Rate</th>
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<tbody>
<tr>
<td>ICA</td>
<td>53%</td>
</tr>
<tr>
<td>MCA</td>
<td>27%</td>
</tr>
<tr>
<td>Basilar</td>
<td>89-96%</td>
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Results:
- High recanalization rates
- Reduced procedure time
- Improved outcomes
DEFUSE 3/DAWN trials

- Pushed patients population for mechanical thrombectomy to 16 hours, then 24 hours respectively from time of onset or LKW (last known well).
- Utilized CT Perfusion imaging for patient selection.

**CT Perfusion**

Epidemiology of Spontaneous Intracerebral Hemorrhage

- Spontaneous intracerebral hemorrhage accounts for 10-15% of all strokes
- The incidence occurs in Blacks and Hispanics and in men more than women
- More notable in young and middle-age than other age groups
- In United States, Australia and Europe-deep, Caudate, internal capsule, thalamic), followed by lobar hemorrhage 50-60% vs 30-50%
- In Japan, deep ICH greatly outnumber lobar ICH 70% vs 30%
- In all populations cerebellar ICH 10% and brainstem ICH 5-10%

Causes of Spontaneous ICH

- Most common cause of stroke is HYPERTENSION, most common cause for deep ICH and brainstem, ? For lobar
- Age is the greatest nonmodifiable risk factor; >60yo
- Amyloid angiopathy-lobar ICH in elderly population
- Aneurysms and vascular malformations (AVM, cavernous malformation, dural AV fistula, venous malformation)-young ages
- Anticoagulation 0.3-0.5% per year with warfarin in most studies (increases to 3.7% with supratherapeutic INR)
- Thrombolyis i.e for MI (0.4-1.5% risk), for stroke with Ivtpa (NINDS-6% risk symptomatic ICH)
Causes of ICH-cont.

- Cerebral microbleeds - prediction of future bleeding risk?
- Prior cerebral infarction
- Hypocholesteremia
- Heavy alcohol use

Deep subcortical ICH

Lobar ICH vs Microbleeds

Spot Sign on CTA

- One or more small regions of contrast enhancement within an acute primary ICH on CTA source images
- Not present on precontrast images
- Corresponds to sites of active, dynamic hemorrhage
- High risk of hematoma expansion

Emergency Management Guidelines

- Recommendations:
  - Rapid neuroimaging with CT or MRI is recommended to distinguish ischemic stroke from ICH (Class I, Level A)
  - CTA angiography and contrast-enhanced CT may be considered to help identify patients at risk for hematoma expansion (Class IIb, Level B)
  - Patients with a severe coagulation factor deficiency or severe thrombocytopenia should receive appropriate factor replacement therapy or platelets, respectively (Class I, Level of Evidence C). Patients with ICH whose INR is elevated because of VKA should have their VKA withheld, receive therapy to replace vitamin K–dependent factors and correct the INR, and receive intravenous vitamin K (Class I, Level of Evidence C). Patients with ICH should have intermittent pneumatic compression for prevention of venous thromboembolism beginning the day of hospital admission (Class I, Level of Evidence A). (Revised from the previous guideline)
Intracerebral Hemorrhage

- For ICH patients presenting with SBP between 150 and 220 mm Hg and without contraindication to acute BP treatment, acute lowering of SBP to 140 mm Hg is safe (Class I; Level of Evidence A) and can be effective for improving functional outcome (Class IIa; Level of Evidence B). (Revised from the previous guideline)
- BP should be controlled in all ICH patients (Class I; Level of Evidence A). (Revised from the previous guideline) Measures to control BP should begin immediately after ICH onset (Class I; Level of Evidence A). (New recommendation)
- Initial monitoring and management of ICH patients should take place in an intensive care unit or dedicated stroke unit with physician and nursing neuroscience acute care expertise (Class I; Level of Evidence B). (Revised from the previous guideline)
- Glucose should be monitored. Both hyperglycemia and hypoglycemia should be avoided (Class I; Level of Evidence C). (Revised from the previous guideline)

Subarachnoid Hemorrhage

- SAH occurs when a blood vessel leaks with extravasation of blood into the subarachnoid space
- Causes: head injury, ruptured aneurysm, illicit drugs (cocaine, amphetamines), amyloid angiopathy, vascular malformation (AVM, dural AV fistula), HTN, ischemia with hemorrhagic conversion, dural venous sinus thrombosis, bleeding disorders
- Symptoms of SAH depend on rapidity, duration and volume of blood
  - Headache, photophobia, meningeal signs, confusion, seizures, decreased LOC secondary to increased ICP and meningeal irritation

Intracranial Aneurysms

- Prevalence 2-5%
- Incidence in Japan and Netherlands as high as 22/100,000 suggesting genetic/environmental component
- Average age: 55 y/o with female predilection
- Multiple aneurysms ~20%
- Prehospital mortality 10-15%
- Incidence of aneurysmal rupture 10/100,000 per year
  - 1-month mortality 30%
  - Rate of rupture if untreated: 40% in 4 weeks with 80% mortality
- Types:
  - Saccular (Berry)
  - Fusiform
  - Mycotic

- All patients must be cared for in a tertiary center with neurology, neuroradiology, and neurosurgery.
  a. Within first few hours of ICH - more than 20% will have decrease in GCS of ≥2 pts b/w prehospital and ED assessments (15% within 1st hour)
  b. Among these-those with decrease in 6 pts have >75% mortality rate
Saccular (Berry) Aneurysm
- Most common cause of nontraumatic SAH
- 90% form in anterior circulation
- Form typically at arterial branch points with altered flow dynamics
  - ACOM 30-35%
  - PCOM 25-30%
  - MCA bifurcation 20%
  - Basilar apex 5-7%

Risk Factors
- Nonmodifiable
  - Age >50
  - Female
  - Family history
    - One 1st degree relative: up to 4% risk
    - Two or more: up to 8%
    - Familial aneurysms rupture at earlier age, more commonly located at MCA
  - AD polycystic kidney disease
  - Connective tissue disorders:
    - Ehlers-Danlos IV
    - Marfan Syndrome
    - Coarctation of Aorta
    - Fibromuscular dysplasia
- Modifiable
  - Tobacco abuse
  - Excessive alcohol consumption
  - Cocaine
  - HTN
  - Homocystinuria

Other Associated Conditions
- Neurofibromatosis I
- Hereditary Hemorrhagic Telangiectasia
- Moya Moya
- Sickle Cell disease
- Tuberous Sclerosis

Screening Guidelines
- Usually not recommended in children/adolescents
- Two 1st degree relatives with aneurysm and AD polycystic kidney disease need screened with imaging studies
- Repeat negative studies every 5 years
- Aneurysm identification following negative study → 7%
- One 1st degree relative → may undergo screening

Clinical Symptoms
- Acute onset thunderclap "worst headache of life" (20%)
  - Can have sentinel headache weeks prior
  - Altered mental status → comatose
  - N/V
  - Meningismus
  - Seizure
  - 3rd nerve palsy—PCOM aneurysm
  - MCA syndrome—MCA aneurysm
  - 3rd, 4th, 5th, and/or 6th nerve palsies—cavernous carotid aneurysms

Predict prognosis and outcome in SAH

<table>
<thead>
<tr>
<th>Hunt &amp; Hess Grading Scale</th>
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<tbody>
<tr>
<td>Grade</td>
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<tr>
<td>1</td>
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<tr>
<td>2</td>
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<td>3</td>
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<td>4</td>
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<td>5</td>
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Hunt & Hess, Neurology 1965; 15:14_S28
Imaging

- Needs completed within 24 hours of admission
- CT head without contrast
- CTA Head: 77-97% sensitivity
- MRA Head: 69-90% sensitivity
  - Sensitivity for CTA/MRA low for aneurysms <3mm
- Digital Subtraction Angiography (gold standard)

Acute Management of SAH

- Prevent rerupture and treat effects of IPH, SAH and IVH
- Treatment of SBP <140 or MAP of <90
- Reversal of antiplatelet and anticoagulant therapy
- AEDs
- Pain management with acetaminophen or opiates without affecting LOC
- Reduce incidence of vasospasm
- Emergent NES evaluation for EVD, embolization/clipping, decompression

Vasospasm

- Peaks at 7-10 days following hemorrhage, risk persists up to 14-21 days
- Degree and density of SAH correlates with development of vasospasm
- Can cause cerebral ischemia
  - Watershed territories
  - Vascular areas distal to aneurysm
- Treatment:
  - Prophylactic nimodipine
  - Daily ➔ BID TCDs
  - Increase BP goals stepwise fashion if signs of vasospasm: SBP 140-160, 160-180, 180-200
  - Fixed fluid rate, monitor I/Os
  - Replace fluids at rate of outs with goal of euvolemia

What are Seizures

- Abnormal Electrical Activity of the brain
- Recurrent Excitatory Connections in the Cerebral Cortex
- Disturbances in the balance of Glutamate (+) vs GABA (-)
  - Lots of squiggly lines

What is Epilepsy

- Condition of recurrent unprovoked seizures.

- When someone comes in with suspected seizure.
  - Questions to ask:
    1) History! History! History!
    2) Preliminary & progression of symptoms (with witness help if available)
    3) Post ictal confusion
    4) Duration of Event
    5) Loss of bowel or bladder function
    6) Biting of tongue (which area of tongue to exam?)
Classification of Seizures

Partial
- Simple Partial – preservation of consciousness
- Motor (Jacksonian March)
- Sensory
- Autonomic
- Complex Partial – LOSS of consciousness
- Aura – Automatisms

Generalized
- Generalized Tonic Clonic (GTC) – LOC
- Absence Seizures
- Atonic Seizures
- Myoclonic seizures (JME)
- Tonic Seizures
- Secondary Generalized
  - Convulsive or Nonconvulsive

Etiology of Primary Seizure Disorder

Intrinsic Causes:
- “Idiopathic”
  - Not attributable to a structural lesion
  - Can be genetic component but not always

Most Common Etiology of Seizures

Young Patients 20-60 yrs old
- Noncompliance with current AED if known seizure patient
- Mesial Temporal Sclerosis
- Medication induced/ Metabolic
- Brain Tumor/Mets
- Meningitis
- Lack of sleep

Older Patients > 60 years old
- Noncompliance with current AED if known seizure patient
- Stroke (ictus for seizure)
- Alzheimer’s Dementia (temporal lobe atrophy and temporal lobes are epileptogenic)
- Brain tumor/Cancer
- Abrupt withdrawal from chronic benzo.

Medications that Lower Seizure Threshold?

- Tramadol (Ultram)
- Demerol
- Wellbutrin
- Ciprofloxacin
- May others

Status Epilepticus

- Seizure lasting >5 minutes in an adult or >10 minutes in a child
  - OR
  - 2 or more seizures in a 30 minute period without return to consciousness

Status Epilepticus

- Convulsive vs Nonconvulsive
- If a seizure lasts more than 30 minutes, cerebral autoregulation is affected, CPP is compromised.
- What is Cushings Triad?
- Mortality with Status Epilepticus 25%. It is a medical emergency. Mortality is linked to duration of seizure.
- More than 90% of patients presenting to ER with SE have no prior history of seizures.
Burst Suppression

- is an electroencephalography (EEG) pattern that is characterized by periods of high-voltage electrical activity alternating with periods of no activity in the brain. The pattern is found in patients with inactivated brain states, such as from general anesthesia, coma, or hypothermia.

Hypertensive Encephalopathy

- Hypertensive emergencies encompass a spectrum of clinical presentations in which uncontrolled blood pressures (BPs) lead to progressive or impending end-organ dysfunction.
- Neurologic end-organ damage due to uncontrolled BP may include hypertensive encephalopathy, cerebral vascular accident/cerebral infarction, subarachnoid hemorrhage, and/or intracranial hemorrhage. [1] Cardiovascular end-organ damage may include myocardial ischemia/infarction, acute left ventricular dysfunction, acute pulmonary edema, and/or aortic dissection.

https://emedicine.medscape.com/article

Joseph L. Izzo Jr., ... Albert Mimran, in Hypertension, 2007

HE: cont.

Symptoms

- Severe headache
- Nausea/vomiting
- Visual disturbance
- Confusion
- Focal or generalized weakness
- Irritability and altered mental status due to cerebrovascular spasm

Exam findings

- Disorientation
- Focal neurological deficits
- Focal or generalized seizures
- nystagmus

HE: Diagnostics

- Ct head: rule out ICH
- Urine: blood, protein, glucose
- Blood for urea, electrolytes and creatinine
- Blood glucose
- 12 lead ECG
HE: goal of treatment

- Acute management: when the patient is in stage 2 of HTN and in urgency or emergency HTN, decline of HTN should be stepwise as follows:
  - 1-25% reduction in the first hour (safer to reduce 25% in the first 8 hours)
  - 2-1/3 reduction in the first 6-8 hours
  - Not achieving below 95% before 24-48 hours
  - Excessive reduction leads to diminished cerebral blood flow, syncope and infarction of the cerebral cortex, brainstem and retina.

  Iran J Child Neurol. 6(3); Summer 2012

HE: management

- Intravenous labetalol: 10-20mg with maximum of 200mg
- Intravenous Nicardipine
- Intravenous hydralazine
- Treat seizures

Meningitis/Encephalitis

Inflammation of the meninges, the membranes that surround the brain and spinal cord, is called meningitis; inflammation of the brain itself is called encephalitis.

Meningitis: Causes

- Bacterial: pneumococcal (most common), meningococcal, haemophilus influenzae, Listeria, E.Coli, Myobacterium tuberculosis
- Viral: enterovirus (varicella zoster, influenza, mumps, HIV, and herpes simplex type 2)
- Fungal: cryptococcus neoformans
- Parasites: cysticercosis

Encephalitis: Causes

- Most are caused by viral infections, however 60% remain undiagnosed.
- Of those diagnosed: HSV most common infection
Symptoms

- Meningitis:
  - sudden fever, severe headache, nausea or vomiting, double vision, drowsiness, sensitivity to bright light, and a stiff neck.
  - often appears with flu-like symptoms that develop over 1-2 days.
  - Distinctive rashes are typically seen in some forms of the disease.
  - Meningococcal meningitis may be associated with kidney and adrenal gland failure and shock.

- Encephalitis
  - Encephalitis: fever, seizures, change in behavior, and confusion and disorientation
  - mild flu-like symptoms
  - more severe cases, people may experience problems with speech or hearing, double vision, hallucinations, personality changes, and loss of consciousness
  - severe complications include loss of sensation in some parts of the body, muscle weakness, partial paralysis in the arms and legs, impaired judgment, seizures, and memory loss.

Diagnostics

- Blood and urine
- Lumbar puncture to analyze Cerebrospinal fluid
- CT with/without contrast
- MRI with/without contrast
- EEG

Treatment

- Meningitis: antibacterials can reduce risk of death, Anti-epileptics, Corticosteroids to reduce brain swelling
- Encephalitis: antivirals, anti-epileptics

- www.ninds.nih.gov

A coma is a prolonged state of unconsciousness. During a coma, a person is unresponsive to his or her environment. The person is alive and looks like he or she is sleeping. However, unlike in a deep sleep, the person cannot be awakened by any stimulation, including pain.

www.webmd.com/brain/coma

Coma

- Lowered level of arousal/consciousness
- Localization: reticular activating system, hypothalamus, bilateral or extensive hemispheric lesions/ (trauma, meningitis/encephalitis, bilateral infarction, metabolic)
- Etiology: structural or metabolic
Coma: respiratory pattern
- Cheyne-Stokes (crescendo-decrescendo)
  - Patterns of hyperpnea alternating with hypopnea
  - Bilateral hemisphere lesions, increased ICP
  - Also seen in sick elderly or CHF patients
- Central neurogenic hyperventilation
  - Rapid, regular hyperpnea
  - Paramedian reticular formation (midbrain/pons, or other brainstem location)
- Respiratory Ataxia
  - Irregular, variably shallow and deep respirations
  - Dysfunction of medullary respiratory center
  - May be a preterminal pattern preceding resp. arrest
- Abnormal respiratory patterns don't always localize, may be seen in systemic disorders

Coma: level of consciousness
- Coma: loss of consciousness, no awareness of self or environment, no voluntary movement or response
- Stupor: partial loss of responsiveness, variable impairment of consciousness, difficulty to arouse but brief response to stimulation possible
- Lethary: arousable and responsive, but unconscious/asleep without stimulation
- Abnormal respiratory patterns don't always localize, may be seen in systemic disorders

Coma: pupil size and reactivity
- Metabolic coma: small, reactive
  - Structural lesion: asymmetric/unreactive
  - Midbrain lesion: large, unreactive pupil(s)
  - Parasympathetic defect
  - Uncal herniation, p comm aneurysm, preterminal
  - Pontine lesion: pinpoint, reactive pupil(s)
  - Sympathetic lesion
  - Opiate toxicity, hyperthermia
  - Midposition unreactive: central transtentorial herniation

Coma: eye/eyelid movements
- Check C-spine if any history of trauma
- Rule out vestibulotoxic drugs
- Conjugate eye deviation
  - Frontal lobe/brainstem lesions
  - Seizure
  - Oculocephalic response (Doll’s Eye Maneuver)
  - Hold eyelids open, briskly rotate head side to side
  - Positive response: conotraversive conjugate eye deviation
  - Corneal reflex

Coma: oculovestibular reflex
- Oculovestibular reflex
  - Cold caloric test: inject 20cc of ice water into external auditory canal, wait up to 60 sec for response
  - Performed if oculocephalics absent
  - Absent response suggests sedative drug intoxication/brainstem structural lesion or brain death
Coma: motor exam

- Tone: flaccidity versus spasticity, asymmetry
- Reflexes: asymmetry, pathologic reflexes
- Response to noxious stimuli
  - Localization and withdrawal
  - Flexion withdrawal
  - Decorticate rigidity
  - Decerebrate rigidity
  - No response
- Decorticate (FLEXOR) posturing
- Flexion of UE
- Extension of LE
- Cortical level
- Decerebrate (EXTENSOR) posturing
- Extension of UE and LE
- Midbrain level
- Myoclonus: anoxia, metabolic coma

Coma: management

- Protect airway, ensure oxygenation, maintain blood pressure
- Correct deficiencies in glucose
- Consider nalaxone
- History/examination
- Urgent, noncontrast head CT
- Check metabolic panel, drug screen

Spinal Cord Emergencies

- Trauma
- Infection
- Tumor
- Cauda Equina

RED FLAGS: History

- Cancer history
- Unexplained weight loss
- Long term use of steroids
- Recent report of serious illness
- Recent report of serious infection
- History of trauma
- IV drug abuse
- Immunosuppression

RED FLAGS: symptoms

- Abdominal pain
- Nocturnal pain dominant
- Thoracic pain
- Pain with sneeze cough or valsala
- Severe pain >4-8 wks (acute, tearing mid-back pain, constant and increasing pain, or constant nonmechanical)

RED FLAGS: exam findings

- Spinal deformity
- Severely limited ROM
- Myospasm with scoliosis or deformity
- Neurological deficit: abnormal reflexes (Hoffman's/Babinski)
- Fever
- Spine tenderness with percussion
- Meningismus
- Severe weakness of extremities
- Sensory deficit (saddle anesthesia, perianal/perineal loss of sensation, loss of anal wink reflex)
Cauda equina syndrome

Refers to a characteristic pattern of neuromuscular and urogenital symptoms resulting from the simultaneous compression of multiple lumbosacral nerve roots below the level of the conus medullaris.

Cauda Equina Syndrome

CES: cont.

- Saddle anesthesia
- Bladder dysfunction (distended bladder; loss of sensation when passing urine)
- Fecal incontinence (loss of sensations of rectal fullness)
- Erectile dysfunction
- Perianal/perineal sensory loss
- Decreased or absent anal sphincter tone
- Severe or progressive neurological deficit in the lower extremities
- Weakness with knee extension, ankle eversion or foot dorsiflexion
- Bilateral lower extremity weakness or numbness

Cauda Equina Syndrome

CES: Causes/Management

- Common: disc, spondylolisthesis, rarely tumor, abscess
- Diagnosis/treatment: Urgent MRI and surgical evaluation with possible surgery
For spinal cord compression:
- May use Dexamethasone when appropriate to reduce edema

AIDP (GBS)

Clinical Features

- Symmetric weakness in proximal and distal muscles and sensory loss
- Preceded by viral illness
- Facial weakness
- Respiratory paralysis - may need ventilation
- Reflexes are absent or hypoactive
- Autonomic instability

Diagnostic Criteria

- AIDP ➔ Progression of symptoms with peak severity within 4 weeks of onset
- CIDP ➔ symptoms greater than 8 weeks
Ancillary testing
- **Serum labs** → usually normal, if clinical suspicion infectious studies including HIV, CMV, Lyme, West Nile can cause acute polyradiculopathy
- **CSF studies**
  - **Albuminocytologic dissociation** with elevated CSF protein in absence of pleocytosis
  - If performed in 1st week can have normal CSF protein

Electrodiagnostic Studies
- **EMG/NCS** → segmental demyelination seen early in course.
- **Nerve Conduction Studies**
  - Slowed conduction velocities
  - Prolonged distal latencies
  - Abnormal temporal dispersion
  - Prolonged F waves
  - Decrease in CMAP amplitudes
- **Electromyography**
  - Fibrillation potentials
  - Long duration of motor unit potentials

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Treatment Options for AIDP
- **IVIG**
  - 0.4mg/kg daily x 5 days
- **Plasma Exchange**
  - Every other day exchange x 5 treatments and then continue twice per week for a few weeks if needed
- No evidence of benefit with oral or IV steroids

Prognosis
- Mortality of AIDP is 2-5%.
- Overall prognosis is good!
- In 85% of patients ambulation is achieved within 6 months
- Poor prognostic factors include:
  - Older age at onset
  - Rapid symptom onset and time to nadir
  - Need for mechanical ventilation early in course
  - EMG evidence of axonal loss with reduced CMAP’s or Fibs.

Other Acute Polyradiculopathies
- **Mimickers of AIDP**
- **Infectious Etiologies**
  - HIV
    - 5% of HIV pts
    - Distal symmetric polyneuropathy
  - Acute polyradiculopathy - check for opportunistic infections (CMV, HSV etc.)
- **CMV**
  - Rapidly progressive acute polyradiculopathy involving lumbar roots
  - In setting of HIV CD4 <50
  - Treatment: ganciclovir or foscarnet

Other Acute Polyradiculopathies
- **6. Sarcoïdosis**
  - Rare polyradiculopathy
- **7. Porphyria**
  - AD metabolic disorder
  - Defect in porphyrin metabolism
  - Classic triad: abdominal pain, psychosis, and liver disease
  - Diffuse progressive weakness, areflexia, preceded by GI illness
  - Treatment: Carbohydrate loading and IV hematin
  - Avoid precipitating factors
- **8. Lymphoma**
  - Rapidly progressive weakness in limbs and trunk
- **9. Intrathecal Medications**
  - Aminoglycosides

3. Lyme Disease
   - Acute motor polyradiculopathy
   - Symmetric weakness and areflexia
   - Check CSF lyme titer via ELISA or PCR
   - Treatment: Antibiotics doxycycline

4. Diphtheria
   - "Pseudomembranes"
   - Throat culture or PCR diagnostic

5. Varicella Zoster Virus
   - Sensory neuropathy, involvement of dorsal root ganglia
   - Vesicular rash in dermatomal distribution

Treatments
   - Similar to CIDP
   - IVIG
   - Plasma Exchange
   - Corticosteroid/Immunosuppressants

Myasthenia Gravis epidemiology
   - Most common disorder of the Neuromuscular Junction (NMJ)
   - Annual incidence 10-20 new cases/million
   - Incidence increases with age
   - Prevalence 150-200/million
   - Female predominance in 20’s and 30’s
   - Male predominance in 60’s and 80’s
   - Mortality rate 5%

MG-Pathophysiology
   - Autoimmune disorder caused by antibodies to postsynaptic proteins
   - Nicotinic acetylcholine receptor (AChR)
   - Muscle specific tyrosine kinase (MuSK)
   - Low-density lipoprotein receptor-related protein 4 (LRP4)
   - Seronegative
   - Thymus

Normal NMJ
   - At the neuromuscular junction, motor neurons release acetylcholine (ACh), which diffuses across the synaptic space and binds to receptors on the muscle cell membrane
   - If enough acetylcholine binds to enough receptors, sodium channels open, and the muscle decharges and contracts.
MG - NMJ

Presentation/Clinical Course

- **Hallmark**
  - Pronounced fluctuating weakness limited to voluntary muscles
  - Muscle exertion increases weakness - FATIGUABLE
    - Ocular weakness
    - Facial & Bulbar
    - Respiratory muscles
    - Proximal extremities & neck

Cholinergic Crisis

- Muscles stop working due to bombardment of acetylcholine
  - Sweating
  - Salivation
  - Flaccid paralysis
  - Respiratory failure
  - Bronchial secretions
  - Miosis
  - N/V/D
  - Bradycardia
- Differentiate from Myasthenic Crisis with Tensilon test
- No pharmacologic treatment for respiratory failure to reverse. Intubation needed until crisis resolves on its own

Myasthenic Crisis (MC)

- Definition: Presence of respiratory failure and need for mechanical ventilation
- 1/5 of pts will experience MC
- MC occurs approximately 8-12 months after initial symptoms
- Presenting manifestation 20% of pts

MC Causes

- Pulmonary infections
- Aspiration
- Surgery
- Trauma
- Pregnancy
- Menstrual cycle
- Extreme temperatures
- Medications – macrolides absolutely contraindicated, extreme caution with neuromuscular blocking agents during anaesthesia
- Stress
- Sleep Deprivation
Neuromuscular Respiratory Failure

- Hypercapnic, hypoxemic, or both
- Secondary to poor airway protection, inadequate secretion clearance, and hypoventilation
- Bulbar dysfunction alters cough, swallow, and sigh mechanisms
- Low threshold for intubation
  - FVC < 20mL/kg, MIP < 30 cm H₂O, MEP < 40 cm H₂O
  - Consider BiPAP

Respiratory Exam

- Presence and degree of oropharyngeal weakness
- Strength of cough or difficulty counting
- Paradoxical breathing with tachypnea, tachycardia, accessory muscle use, abnormal O₂ sats
- ABG

MC Pharmacologic Treatment

- Immunomodulatory agents
  - IVIG or PE
- Anti-inflammatory/Immunosuppressant agents
  - Corticosteroids
  - Azathioprine
- Cholinesterase inhibitors
  - Oral pyridostigmine or parenteral neostigmine

MC Complications

- Fever
- Pneumonia
- Bronchitis
- UTI
- C-diff
- Sepsis
- Bacteremia
- DVT
- CHF
- MI
- Arrhythmias
- Cardiac Arrest

Treatment

- Acetylcholinesterase inhibitors
  - Usually pyridostigmine – 1st line RX
  - Increasing tolerance over time may necessitate dose escalation
  - Monitor for cholinergic crisis
- Short Term Immunosuppression
  - Usually Prednisolone – start at low dose
  - Used while titrating up long term immunosuppression
  - Do not stop early or rapid taper
Treatment Cont.
• **Long-term immunosuppression**
  - Azathioprine – 1st line
  - Methotrexate – 2nd line
  - Ciclosporin & cyclophosphamide –
    (Used in severe cases or refractory to above)
• **Rapid short-term immunomodulation**
  - Intravenous immunoglobulin (IVIG)
  - Plasma Exchange (PE)
  - Used myasthenic crisis
  - Prior to surgery

(Adhus et al., 2014)

Treatment Cont.
• **Long – term immunomodulation**
  • Thymectomy
    - In all patients with thymoma
    - In non-thymomatous pts < 65 yrs old with positive AChR
      antibodies and within 3 years of diagnosis
    - Contraindicated in pts with positive MuSK antibodies
  • Rehab

(Adhus et al., 2014)