Chief Complaint: Weakness	
CNS Manifestations of Lyme Disease	
Management	See previous
Complications	Complications of meningitis, facial palsy, peripheral neuritis
Stroke[6]	
PowerPlans	Please call a code stroke if symptom onset < 5 hours prior (x52170); Neuroscience ICP admit plan or Neuro stroke plan, See Neurology Card
Pathophysiology	Acute onset neurologic dysfunction due to impaired blood supply to the brain; ischemic or hemorrhagic
Presentation	Acute onset unilateral weakness or numbness, acute onset altered mental status, new-onset focal seizures
Differential	Todd's paralysis following focal seizure, hemiplegic migraine, venous sinus thrombosis
Red Flags	Risk factors include infection, pro-thrombotic state, leukocytosis and anemia Risk factors for arterial ischemic stroke include Sickle Cell Disease and Cardiac Disease Risk factors for venous stroke are IBD, auto-immune disorders, infections and dehydration
Workup	Brain MRI/MRA w/ stroke protocol (includes DWI/ADC, FLAIR, T2, T1, susceptibility sequences) +/- MRV. TTE look for cardiac causes, serum labs to look for coagulopathy, if newborn add metabolic studies
Management	ABC's! Head of bed flat; IVF at maintenance, target SBP 50-90th percentile for age. Maintain euglycemia and normothermia, treat seizures, consider PICU admission and neurosurgical consult
Complications	Malignant edema which may lead to herniation, hemorrhagic conversion **(consider STAT CT for change in exam)**

1. Jones, H. Guillain-Barre Syndrome: Perspectives w/ Infants and Children. Seminars in Pediatric Neurology June 2000.
2. Shahrizaila, N, and Yuki, N. Bickerstaff brainstem encephalitis and Fisher Syndrome: anti-GQ1B antibody syndrome. Journal of Neurology, Neurosurgery and Psychiatry 84(5). 2013.
3. Krupp et al. International Pediatric Multiple Sclerosis Study Group criteria for pediatric multiple sclerosis and immune-mediated central nervous system demyelinating disorders: revisions to the 2007 definitions. Multiple Sclerosis Journal. April 2013.
4. Thompson et al., Infant Botulism in the age of botulism immune globulin. Neurology. June 2005.
5. Peragallo, J. Pediatric Myasthenia Gravis. Seminars in Pediatric Neurology. May 2017.
6. Lehman, et al., Transient focal neurologic symptoms correspond to regional cerebral hypoperfusion by MRI: A stroke mimic in children. American Journal of Neuroradiology. July 2017.

Chief Complaint: Altered Mental Status	
Meningitis: Inflammation of the leptomeninges secondary to infection **Encephalitis**: Infection of brain parenchyma secondary to infection (altered mental status, focal neurologic deficits)	
Bacterial Meningitis	
PowerPlans	**Fever in infant < 30 days**
Pathophysiology	Bacterial infection of the meninges. Caused by hematogenous spread or direct spread from sinuses or mastoids
Presentation	• Fever, headache, vomiting, meningismus, seizures • **Kernig Sign**: Stretching of hamstring w/ knee extension + back pain • **Brudzinski Sign**: passive neck flexion, involuntary hip/knee flexion
Differential	Viral meningitis/encephalitis, brain abscess, increased ICP, neoplasm, ADEM

Altered Mental Status continued on next page →

Chief Complaint: Altered Mental Status

Bacterial Meningitis

Red Flags	Focal neurological deficits, seizures, papilledema. Risk factors for TB (poor clinical outcomes), petechiae on exam (Neisseria)
Workup	It's all about the LP. CSF: WBC count often > 1,000, glucose often < 40 or < half of serum value, protein > 250, cell count w/ > 50% PMNs. Obtain imaging on comatose patients or those w/ focal neurologic deficits PRIOR to LP.
Management	In addition to ABX, dexamethasone used to reduce hearing loss in children 0.15mg/kg q6hr for 2-4 days. See table for ABX.
Complications	Seizure, stroke, elevated intracranial pressure

Age	Pathogen	Treatment
0-1 month	GBS, E. Coli, L. monocytogenes, S. pneumo	Ampicillin 75-100mg/kg q6-q8hr AND Cefotaxime 50 mg/kg q8hr OR Gentamicin 4mg/kg/dose q24hr
1-3 months	S. pneumo, E. coli, Neisseria, GBS, L. monocytogenes, H. flu	Ampicillin 50-100mg/kg q6-q8hr AND Cefotaxime 100mg/kg q8hr or Ceftriaxone 100mg/kg q6-8hr
3- 18 months	N. meningitides, S. pneumo, H. Influenzae	Cefotaxime 100mg/kg q8hr or Ceftriaxone 100mg/kg q6-8hr AND Vancomycin

Viral Meningitis and Encephalitis

PowerPlans	None
Pathophysiology	Viral infection and inflammation of the meninges
Presentation	Fever, headache,malaise, photophobia, altered mental status
Differential	HSV (HSV-1 most common in children, HSV-2 most common in neonatal period acquired through maternal transmission), EBV, VZV, CMV (consider if immunocompromised), Eastern Equine Virus, Subacute sclerosis panencephalitis (if remote hx of measles infection), Lyme
Red Flags	History of immunosuppression, transplant: consider less common organisms
Workup	• Consider MRI if focal neurologic deficits are present • LP should be performed; CSF profile w/ elevated protein and cells, lymphocytic pleocytosis.
Management	Largely supportive, w/ empiric treatment w/ antibiotics and acyclovir until cultures result HSV = Acyclovir 14 to 21-day course (<35 wk conceptual age 40 mg/kg/d divided q12; > 35 wk conceptual age 60 mg/kg/d divided q8hr); CMV = Ganciclovir
Complications	Rarely associated w/ long-term issues; HSV may cause hemorrhage w/i temporal lobes, causing seizures

Acute Disseminated Encephalomyelitis (ADEM)[1]

PowerPlans	N/A
Pathophysiology	Central demyelinating disorder, presumed immune-mediated mechanism
Presentation	Lethargy, headache, vomiting, focal neurological symptoms
Differential	Multiple Sclerosis, infectious/toxic/metabolic encephalitis leukodystrophy

Chief Complaint: Altered Mental Status	
Acute Disseminated Encephalomyelitis (ADEM)[1]	
Red Flags	Decreased level of arousal can indicate need for intubation for airway protection
Workup	MRI brain and spine w/ and w/o contrast, LP. T2 weighted MRI reveals confluent increased signal intensity throughout white matter, specifically corpus callosum and periventricular region; CSF can be normal or have elevated protein or WBC.
Management	High dose IV methylprednisolone; IVIG and plasma exchange may help refractory cases
Complications	• Typically a self-limiting, monophasic course • Multiple episodes raise concern for MS/MOG-associated demyelination
Autoimmune Encephalitis (NMDA Receptor Antibody Encephalopathy)[2]	
PowerPlans	N/A
Pathophysiology	• Antibodies bind to NR1 subunit of NMDAR and cause receptor endocytosis and subsequent neurologic dysfunction • Ovarian teratomas are an important cause in girls < 18 (31 %); Tumors rare in males • Overall, a rare disease
Presentation	Acute (<3 months) behavior and personality changes (including depression/anxiety/psychosis), seizures, stereotyped movements and autonomic instability
Differential	Viral encephalitis,neuroleptic malignant syndrome, psychosis, catatonia
Red Flags	Autonomic instability
Workup	• MRI Brain typically w/ lesions • EEG can show slowing and delta brush • ELISA test of Ab against NR1 subunit of NMDA receptor (autoimmune encephalitis panel) is diagnostic
Management	• If applicable, tumor resection • Methylprednisolone 30mg/kg (max 1g) IV daily x5d, IVIG 2g/kg over 2 to 5 days and plasma exchange are all first line treatments
Complications	Autonomic instability, seizures

1. Krupp et al. International Pediatric Multiple Sclerosis Study Group criteria for pediatric multiple sclerosis and immune-mediated central nervous system demyelinating disorders: revisions to the 2007 definitions. Multiple Sclerosis Journal. April 2013.
2. Dalmau, J. Clinical experience and laboratory investigations in patients w/ anti NMDAR encephalitis. Lancet Neurology. January 2011.

Chief Complaint: Headache	
Migraine	
PowerPlans	Migraine EBG
Pathophysiology	Cortical spreading depression: neurons fire in a sequential manner across the surface of the brain (causing an aura); associated w/ irritation and dysregulation of blood vessel tone of the overlying meninges, causing pain.
Presentation	Unilateral throbbing headache (frontal in young children), visual aura, photophobia, phonophobia, nausea, vomiting, relieved by rest
Differential	Venous sinus thrombosis, concussion, tension type headache, intracranial mass lesion

Headache continued on next page →