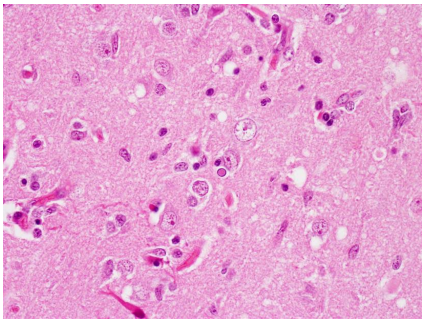
Question #

302 PEDIATRIC NEUROLOGY

Neuropathology

Subacute sclerosing panencephalitis (SSPE) is caused by defective measles virus replication secondary to natural measles virus infection before age 2 years. Having become rare, SSPE may increase again with the recent decrease in vaccination rates. Intranuclear eosinophilic inclusions and demyelination are seen histologically. Premortem diagnosis can be made by serum or CSF virus-specific IgG.

Yachnis A, Rivera-Zengotita M. High Yield Pathology: Neuropathology. Philadelphia, PA: Elsevier; 2014.

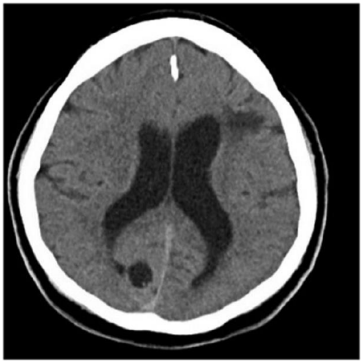


339 ADULT NEUROLOGY CORE KNOWLEDGE

Neuroimaging

The juxtaventricular lesion shown is characteristic of the vesicular stage of neurocysticercosis: a spherical cystic lesion with eccentric calcification (scolex) with no surrounding edema. All other disorders listed (primary CNS malignancy, toxoplasmosis, bacterial abscess, metastasis from a systemic cancer) are likely to have surrounding edema, not this cystic appearance with eccentric calcification.

Raibagkar P, Berkowitz AL. The many faces of neurocysticercosis. J Neurol Sci. 2018 Jul 15; 390:75–76.



Question #

386 NO SPECIFIED PATIENT AGE CORE KNOWLEDGE

Neuroscience and Mechanism of Disease

The CSF cryptococcal antigen (CrAg) lateral flow assay is the preferred test for confirming cryptococcal meningitis: it is sensitive, specific, results rapidly, and is widely available. India ink stain is insensitive, culture is sensitive and specific but takes days to return, and PCR is sensitive and specific but not widely available.

Grill MF. Neurologic complications of human immunodeficiency virus. Continuum Lifelong Learning Neurol. 2021 Aug;27(4):963–991.

Question #

313 ADULT NEUROLOGY CORE KNOWLEDGE

Treatment/Management

Insomnia is defined as the combination of difficulty sleeping, lack of sleep, and daytime problems that include fatigue, mood, and behavioral issues. Symptoms need to be present at least three times a week for 3 months to be considered insomnia.

Patients typically have sleep latency of more than 30 minutes, prolonged waking or waking 30 minutes or more before their planned wake time. While numerous medications are available to treat insomnia, behavioral therapies are more effective with minimal adverse effects. These include cognitive behavioral therapy, brief behavioral treatment, and mindfulness therapies.

Kutscher S, Juang C. Insomnia. Continuum Lifelong Learning Neurol. 2023 Aug;29(4): 1167–1187.

375 PEDIATRIC NEUROLOGY CORE KNOWLEDGE

Clinical Aspects of Disease

The abnormal movements described are consistent with myoclonus during sleep and the transition to sleep but not during wakefulness. The patient has a normal tone exam, Moro reflex, and clonus as allowed for age.

Benign neonatal seizures can start in the first week of life and do not resolve with awakening. Early myoclonic epileptic encephalopathy is associated with burst suppression on EEG; clinically, this would be associated with encephalopathy, not described here, and occur in both sleep and wakefulness. Hyperekplexia, an exaggerated startle response, is not described. Sandifer syndrome refers to abnormal posturing secondary to gastroesophageal reflux.

Facini C, Spagnoli C, Pisani F. Epileptic and non-epileptic paroxysmal motor phenomena in newborns. J Matern Fetal Neonatal Med. 2016 Nov;29(22):3652–3659.

Question #

387 ADULT NEUROLOGY

Treatment/Management

Pramipexole use has the highest prevalence of sleep attacks (50%) compared with ropinirole. Pregabalin and gabapentin are indicated for restless legs syndrome but not Parkinson disease. These medications may cause somnolence or drowsiness but are not associated with sleep attacks. Selegiline is a monoamine oxidase B (MAO-B) and reduces daytime sleepiness.

Yeung EYH, Cavanna AE. Sleep attacks in patients with Parkinson's disease on dopaminergic medications: a systematic review. Mov Disord Clin Pract. 2014;1(4):307-316.

Gallazzi M, Mauri M, Bianchi ML, et al. Selegiline reduces daytime sleepiness in patients with Parkinson's disease. Brain Behav. 2021 May;11(5):e01880.

393 ADULT NEUROLOGY CORE KNOWLEDGE

Clinical Aspects of Disease

This patient's symptoms are consistent with cataplexy, an emotionally induced loss of strength and postural tone. Excessive daytime sleepiness and cataplexy are the most commonly occurring accompaniments of narcolepsy, with hypnagogic hallucinations and sleep paralysis being less common. Other associated symptoms may include vivid dreams, fragmented unrestful nocturnal sleep, automatic behaviors, periodic limb movements of sleep and REM sleep behavior disorder.

Malhotra S, Kushida CA. Primary hypersomnias of central origin. Continuum Lifelong Learning Neurol. 2013 Feb:19(1):67-85

Blattner M, Maski K. Central disorders of hypersomnolence. Continuum Lifelong Learning Neurol. 2023 Aug 1;29(4):1045-1070.

399 ADULT NEUROLOGY

Neurophysiology

This patient most likely has REM sleep behavior disorder (RBD) in which there is impairment of REM-induced atonia. Patients appear to physically enact their dreams. The polysomnogram in RBD demonstrates muscle activity by EMG during REM sleep. RBD is more common in patients with degenerative brain diseases, including Parkinson disease.

Frequent arousals and apneic episodes are associated with obstructive sleep apnea. Sleep-onset REM is seen with narcolepsy, and epileptiform activity is associated with a seizure disorder.

Boeve BF REM sleep behavior disorder: Updated review of the core features, the REM sleep behavior disorder-neurodegenerative disease association, evolving concepts, controversies, and future directions. Ann N Y Acad Sci. 2010 Jan;1184:15-54.

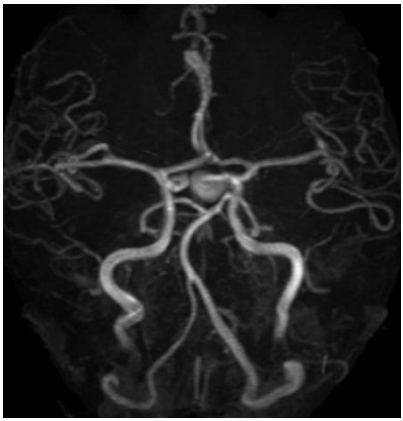
Question #

222 ADULT NEUROLOGY CORE KNOWLEDGE

Neuroimaging

The 1.6- x 0.9-cm mass seen represents a saccular aneurysm of the left internal carotid artery that projects medially. After diagnosis, this aneurysm was successfully treated with endovascular coil.

Brazis PW, Masdeu JC, Biller J (eds). Localization in Clinical Neurology. 8th ed. Philadelphia: Wolters Kluwer; 2022.



238 ADULT NEUROLOGY CORE KNOWLEDGE

Neuroanatomy

An aneurysm in the posterior communicating artery may compress cranial nerve III, leading to ipsilateral pupillary dilation and ophthalmoparesis.

Blumenfeld H. Neuroanatomy Through Clinical Cases. 3rd ed. Sunderland: Sinauer Associates; 2021.

251 ADULT NEUROLOGY SUBSPECIALTY KNOWLEDGE

Clinical Aspects of Disease

Gerstmann syndrome includes agraphia, finger agnosia, right-left disorientation, and acalculia. When all four features are present, the lesion is most often in the dominant (usually left) inferior parietal lobule, which includes the supramarginal and angular gyri.

Blumenfeld H. Neuroanatomy Through Clinical Cases. 3rd ed. Sunderland: Sinauer Associates; 2021.

Tang-Wai D, Freedman M. Bedside approach to the mental status assessment. Continuum Lifelong Learning Neurol. 2018 Jun;24(3):672-703.

Question #

264 ADULT NEUROLOGY SUBSPECIALTY KNOWLEDGE

Diagnostic Procedures

This patient's echocardiogram findings are consistent with an intrapulmonary shunt, suggested by passage of bubbles in the later stage of the test, on or after five cardiac cycles. This finding can be seen in pulmonary arteriovenous malformations (AVMs), which is a source of ischemic stroke. The next step in workup is to confirm or rule out an pulmonary AVM via CT angiography of the chest.

Cardiology consult is not necessary as the test does not show a patent foramen ovale, which would involve early passage of bubbles to the left atrium. Pulmonary function tests, chest radiography, and cardiac MRI do not help characterize or rule out pulmonary AVM.

Bhatia N, Abushora MY, Donneyong MM, et al. Determination of the optimum number of cardiac cycles to differentiate intra-pulmonary shunt and patent foramen ovale by saline contrast two- and three-dimensional echocardiography. Echocardiography. 2014 Mar;31(3):293-301.

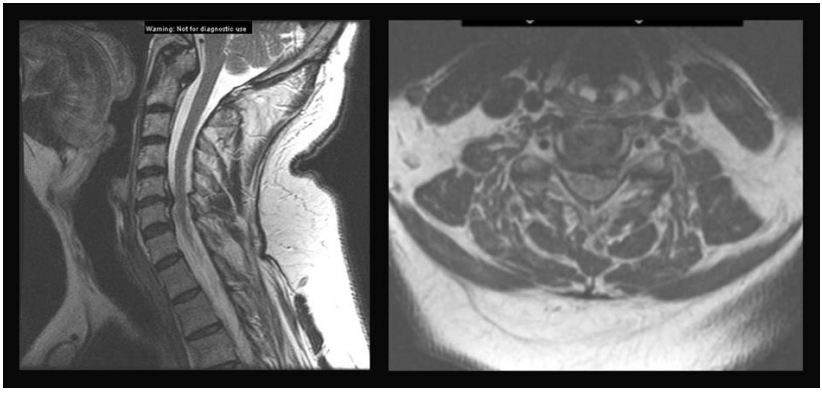
Question #

391 ADULT NEUROLOGY CORE KNOWLEDGE

Neuroimaging

The elevated dura is visible as a thin hypointense line on the sagittal T2–weighted MRI scan. This extradural localization makes intradural compression by metastasis or osteophyte incorrect. The herniation lesion is centered at the disk and is isointense to the disk. Abscess, lymphoma, and metastasis would not be localized in the disk.

Diehn FE, Krecke KN. Neuroimaging of spinal cord and cauda equina disorders. Continuum Lifelong Learning Neurol. 2021 Feb;27(1):225–263.



Question #

392 PEDIATRIC NEUROLOGY

Contemporary Issues

In some states, pregnancy may be terminated at any time during gestation. However, once an infant is born, it has the rights afforded to all people. While parents serve as surrogate decision makers, treatment decisions must be directed by the best interests of the child.

Clinicians must assess, to the best of their abilities, an infant's prognosis with and without certain interventions. If the infant is likely to survive and the risk of unacceptably severe morbidity is low, withholding indicating interventions is not appropriate. In the situation described, if all medical/surgical care is pursued, this infant is likely to survive and perhaps have mild to moderate disability. If nutrition is withheld, or if the infant does not undergo an indicated neurosurgical intervention, suffering and death are likely. The rights of an infant to receive this care supersede parental rights.

At this time, there is no indication that the infant in this scenario will need to be placed in protective custody. A discussion between the health care team and the parents is needed first to ensure the parents understand the prognosis and why medical intervention/nutrition cannot be withheld.

American College of Obstetricians and Gynecologists. Committee on Obstetric Practice, Committee on Ethics. ACOG Committee Opinion Number 786 Perinatal Palliative Care. Pediatrics. 2019 Dec;144(6):e20193146.

de Vos MA, Seeber AA, Gevers SKM, et al. Parents who wish no further treatment for their child. J Med Ethics. 2015 Feb;41(2):195–200.

American Academy of Pediatrics Committee on Fetus and Newborn; Bell EF. Noninitiation or withdrawal of intensive care for high-risk newborns. Pediatrics. 2007 Feb;119(2):401–403.

Racine E, Shevell MI. Ethics in neonatal neurology: When is enough, enough? Pediatr Neurol. 2009 Mar;40(3):147–155.

Question #

390 PEDIATRIC NEUROLOGY CORE KNOWLEDGE

Neuroscience and Mechanism of Disease

This patient has metachromatic leukodystrophy (MLD), a disorder caused by deficient activity of lysosomal enzyme arylsulfatase A. In the late infantile form, this disease is characterized by rapid loss of motor function, followed by loss of cognitive function. MRI studies generally reveal T2 signal abnormalities in the frontal and parietal regions with radial stripes (tigroid pattern). This pattern can also be seen in Pelizaeus_Merzbacher disease and globoid cell leukodystrophy. Multiple cranial nerve enhancement is also an MRI finding seen in MLD.

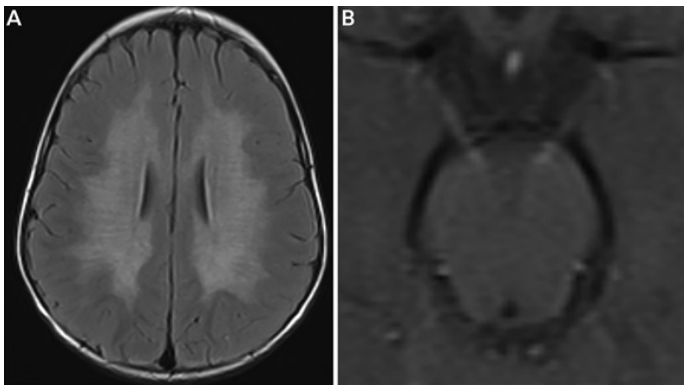
Rett syndrome is caused by mutation in the *MECP2* gene and is characterized by a normal early development followed by slowing in development, loss of motor function, and characteristic hand movements. MRI images are characterized by global atrophy.

Pathologic variants in *GFAP* cause Alexander disease, which generally presents with epilepsy, macrocephaly, developmental delay, and failure to thrive. MRI studies show diffuse symmetric white matter signal abnormalities, predominantly affecting the frontal lobes.

Mutations in *DMD* cause Duchenne muscular dystrophy, which is not associated with central demyelination.

Aspartoacylase deficiency is present in Canavan disease, a disorder characterized by delayed development in the first year of life followed by developmental delay. MRI images show central diffuse hyperintense signal in the cortex and basal ganglia.

Adang L. Leukodystrophies. Continuum Lifelong Learning Neurol. 2022 Aug;28(4): 1194–1216.



Question #

398 ADULT NEUROLOGY

Neuroscience and Mechanism of Disease

Immune checkpoint inhibitors have been associated with development of paraneoplastic neurologic syndromes. This patient demonstrates clinical symptoms of opsoclonus and ataxia, most suggestive of an anti-Ri/antineuronal nuclear antibody type 2 paraneoplastic syndrome, which is often associated with breast cancer.

Pembrolizumab (a programmed cell death protein 1 inhibitor) is approved for treatment of triple negative breast cancer. Subsequent upregulation of the immune system has permitted a paraneoplastic syndrome to emerge. The other mechanisms listed are used in the treatment of breast cancer (paclitaxel, gemcitabine, carboplatin, doxorubicin) but would not likely result in the clinical presentation.

Gill AJ, Perez MA, Perrone CM, et al. A case series of PD-1 inhibitor-associated paraneoplastic neurologic syndromes. J Neuroimmunol. 2019 Sep 15:334:576980.

Question #

378 ADULT NEUROLOGY

Diagnostic Procedures

Amyloid-related imaging abnormalities (ARIA) are related to the increased permeability of amyloid-laden blood vessels to fluid or blood products that can occur in the setting of cerebral amyloid angiopathy and as a result of amyloid mobilization by lecanemab.

The ClarityAD phase 3 trial reported infusion-related reactions and ARIA, specifically ARIA with hemosiderin (ARIA-H) and ARIA-edema/effusion (ARIA-E). The edema seen in ARIA-E is vasogenic, not cytotoxic. The incidence of ARIA-H reactions (eg, microhemorrhages and superficial siderosis) was 17.3% in patients taking lecanemab compared with 9% in those receiving a placebo. The incidence of ARIA-E reactions was 12.6% in the treatment group compared with 1.7% in the placebo group.

MRI recommendations include the following: at baseline before initiation of treatment and then before the fifth, seventh, and fourteenth infusions to monitor for ARIA-E or ARIA-H.

Based on a patient's clinical symptoms and the severity the findings seen on imaging studies, clinical judgment is needed when considering to continue dosing or temporarily or permanently discontinue lecanemab. The appearance of new microhemorrhages would warrant a pause in treatment, assessment of the patient, and review of imaging studies.

The empty delta sign is created by a nonenhancing thrombus in the dural sinus surrounds by a triangular enhancing dura as see on cross-section. It suggests a dural sinovenous thrombosis. The dural tail sign is a thickening and enhancement of the dura in continuity with a mass, usually highly specific for a meningioma. The hummingbird sign is significant midbrain atrophy with pons atrophy associated with progressive supranuclear palsy. The edema seen in ARIA-E is vasogenic, not cytotoxic.

van Dyck CH, Swanson CJ, Aisen P, et al. Lecanemab in early Alzheimer's disease. N Engl J Med. 2023 Jan 5;388(1):9-21.

Cummings J, Apostolova L, Rabinovici GD, et al. Lacanemab: appropriate use recommendations. J Prev Alz Dis. 2023;3(10):362-377.

Virhammar J, Blohme H, Nyholm D, et al. Midbrain area and the hummingbird sign from brain MRI in progressive supranuclear palsy and idiopathic normal pressure hydrocephalus. J Neuroimaging. 2022 Jan;32(1):90-96.

Chavhan GB, Shroff MM. Twenty classic signs in neuroradiology: a pictorial essay. Indian J Radiol Imaging. 2009 May;19(2)L135-145.

Question #

400 ADULT NEUROLOGY SUBSPECIALTY KNOWLEDGE

Clinical Aspects of Disease

This patient had a stroke in his dominant (left) occipital region with expansion into the splenium. This would typically cause a syndrome of alexia without agraphia. There is a lesion in his left calcarine cortex as a result of the stroke; thus, the only visual input is coming into his right calcarine cortex.

The written words that he sees must cross through the splenium of the corpus callosum to be interpreted as words by the language centers in his dominant (left) hemisphere. Because the splenium was also involved in the stroke, words cannot cross over to the left hemisphere; therefore, he is unable to read (alexia).

Writing (graphia) is still intact because it requires more anterior regions and visual input to write letters. Left-hand agraphesthesia and astereognosis might be seen if a callosal disconnection of the parietal regions anterior to the splenium is present. Conduction aphasia typically occurs from a disconnection between the Wernicke and Broca areas on the left.

Brazis PW, Masdeu JC, Biller J. Localization in Clinical Neurology. 7th ed. Philadelphia: Lippincott Williams and Wilkins; 2017.

Blumenfeld H. Neuroanatomy Through Clinical Cases. 3rd ed. Sunderland: Sinauer Associates; 2021.