Robbins Review Questions

1. A 16-year-old boy with no prior medical problems has complained of headaches for the past 9 months. There are no abnormal findings on physical examination. CT scan of the head shows enlargement of the lateral cerebral ventricles and third ventricle. A lumbar puncture is performed with normal opening pressure, and clear CSF is obtained, which has a slightly elevated protein, normal glucose, and no leukocytes. Which of the following intracranial lesions is most likely to cause these findings?

A. Aqueductal stenosis
B. Cerebral abscess
C. Cryptococcal meningitis
D. Ependymoma
E. Multiple sclerosis
F. Vascular malformation

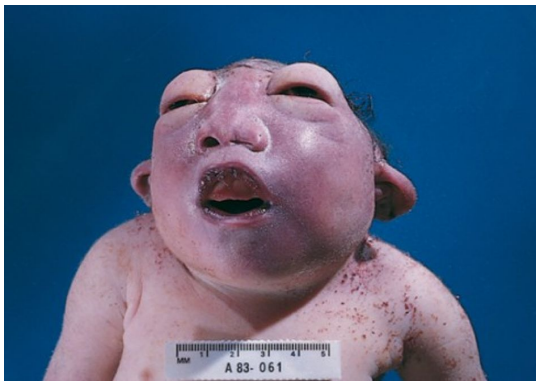
D. This is noncommunicating hydrocephalus with obstruction below the level of the third ventricle. If hydrocephalus had been present at birth, there would be increasing head size because the sutures are not yet closed, and congenital aqueductal stenosis would be suspected. At his age, a neoplasm should be suspected, and ependymomas arise in the ventricular system, often in the fourth ventricle, to cause obstruction of CSF flow. The increased CSF protein comes from this tumor, but shedding of cells from the mass into the CSF is unlikely. Except for vascular malformation, the other options are uncommon at his age. An abscess is typically accompanied by fever, and most would be located in the cerebral hemispheres away from the ventricular system. Cryptococcal meningitis is accompanied by fever, and exudate can be found within the ventricular system and subarachnoid space, but there is more likely to be cerebral edema, not hydrocephalus. The demyelinating plaques of multiple sclerosis are small and do not usually act as mass lesions. Vascular malformations usually arise in the cerebral hemispheres.

2. A 45-year-old man develops a severe headache and fever over 2 days. On physical examination, he has nuchal rigidity and bilateral papilledema. His temperature is 38.5° C. A blood culture shows gram-positive cocci in chains, and *Streptococcus pneumoniae* is identified. The figure shows the representative gross appearance of a section of his brain. Based on this appearance, which of the following complications most likely resulted from this patient's infection?

A. Abscess formation
B. Herniation
C. Hydrocephalus
D. Laminar cortical necrosis
E. Subarachnoid hemorrhage

B. The figure shows linear midline hemorrhages, called Duret hemorrhages, in the pons. The acute bacterial meningitis led to brain swelling with edema and subsequent herniation of medial temporal lobe with Duret hemorrhages in the pons. Although not seen in this figure, an infection could organize with scarring of foramina to produce a noncommunicating hydrocephalus, or it could scar the vertex and impair reabsorption of CSF at the arachnoid granulations to produce a communicating hydrocephalus. An abscess infre-quently complicates meningitis; conversely, an abscess in a paranasal sinus or mastoid air cell may extend into the cranial cavity to cause meningitis. Laminar necrosis could occur after brain death, but this finding is not specific for meningitis. The small meningeal vessels do not often bleed because of inflammation caused by meningitis.

3. A 30-year-old woman, G3, P2, is in the third trimester of pregnancy. She has noted minimal fetal movement throughout the pregnancy. A fetal ultrasound scan shows normal amniotic fluid volume, normally implanted placenta, and the abnormality shown in the figure. Which of the following laboratory findings is most likely to be present in this woman?
   A. 45, XX, t(14;21)(p11;q11) karyotype
   B. Elevated serum α-fetoprotein level
   C. High cytomegalovirus IgM titer
   D. Hyperbilirubinemia with anemia
   E. Increased hemoglobin A_{1c} level



B. Anencephaly is a form of severe neural tube defect that results from failure of formation of the fetal cranial vault. This is one of the most common CNS malformations seen at birth. The defect allows fetal α-fetoprotein to enter amniotic fluid and reach the maternal circulation. The karyotype listed is that of a Robertsonian Down syndrome carrier; Down syndrome (trisomy 21) may be associated with brachycephaly, but rarely with anencephaly. Congenital cytomegalovirus infection can produce extensive fetal brain parenchymal necrosis, but not loss of the fetal cranial vault. Neural tube defects are not associated with maternal or neonatal jaundice. Diabetes mellitus, suggested by an elevated hemoglobin A1c concentration, can increase the risk of malformations (e.g., holoprosencephaly in the CNS), but not neural tube defects.

4. A 72-year-old woman trips and falls down the stairs. She does not lose consciousness. She develops a headache and confusion 30 hours later and is taken to the emergency department. On physical examination, she is conscious and has a scalp contusion on the occiput. What is the most likely location of an intracranial hemorrhage in this patient?
   A. Basal ganglia
   B. Epidural
   C. Pontine
   D. Subarachnoid
   E. Subdural

E. A subdural hematoma results from tearing of the bridging veins beneath the dura. These veins are at risk of tearing with head trauma, particularly in elderly individuals, in whom some degree of cerebral atrophy may be pres- ent. Bleeding from low-pressure veins produces a variable time course for appearance of signs and symptoms, from hours to days to weeks. Basal ganglia hemorrhages are most often associated with hypertension. Epidural hemorrhages are most often preceded by a blow to the head that tears the middle meningeal artery; there is commonly a "lucid" interval between an initial loss of consciousness occurring with trauma and the later accumulation of blood. Pontine hemorrhages are likely to be Duret hemorrhages. Subarachnoid hemorrhage could occur in contusions with trauma.

5. A 79-year-old man with metabolic syndrome has had 6 episodes of sudden dysarthria, a feeling of weakness in his hand, and dizziness in the past 3 months. These episodes usually last less than 1 hour, and then he feels fine. Today, he suddenly lost consciousness while walking to the bathroom in his house and fell to the floor. On regaining consciousness 4 minutes later, he was unable to move his right arm. Which of the following underlying lesions is most likely to be found in his brain?
   A. Arteriovenous malformation
   B. Cerebral atherosclerosis
   C. Frontal lobe astrocytoma
   D. Meningoencephalitis
   E. Subdural hematoma

B. The brief episodes of neurologic dysfunction represent transient ischemic attacks (TIAs) and are a prodrome to stroke in many cases. Atherosclerotic cerebrovascular disease is a common antecedent to cerebral infarction, and metabolic syndrome with dyslipidemia and hyperglycemia is a risk factor. A vascular malformation most often produces symptoms caused by bleeding in young adults. A neoplasm is unlikely to produce such sudden, episodic symptoms and signs. Meningoencephalitis may produce general features such as fever, headache, confusion, and seizures, but not sudden localizing signs. A subdural hematoma, which most frequently results from head trauma sustained in a fall, is unlikely to develop in a few minutes and would not explain the TIAs.

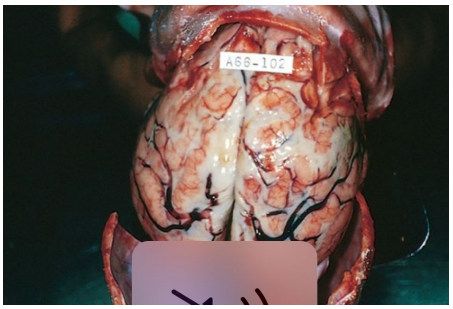
6. A 50-year-old woman develops a sudden, severe headache and is taken to the emergency department. On examination, she has nuchal rigidity. Her blood pressure is 115/83 mm Hg. A lumbar puncture is done; the CSF shows numerous RBCs, no neutrophils, a few mononuclear cells, and a normal glucose level. The Gram stain result is negative. CT imaging shows subarachnoid hemorrhage at the base of the brain. Which of the following vascular events has most likely occurred in this woman?
   A. Bleeding from cerebral amyloid angiopathy
   B. Hematoma formation from arteriolosclerosis
   C. Middle cerebral artery thromboembolism
   D. Rupture of an intracranial berry aneurysm
   E. Tear of subdural bridging veins

D. About 1 in 50 individuals has a saccular (berry) aneurysm. Although this lesion is present at birth as a congenital defect in the arterial media at intracerebral arterial branch points, it can manifest later in life with aneurysmal dilation and possible rupture. These aneurysms are the most common cause of spontaneous subarachnoid hemorrhage in adults. The bleeding from amyloid angiopathy is in peripheral cortex, and most likely to occur in association with Alzheimer disease. A hypertensive hemorrhage from arteriolosclerosis tends to remain within the brain parenchyma. Thromboemboli can cause infarctions, most often in the distribution of the middle cerebral artery in cortex, and embolic infarcts can be hemorrhagic, but the blood typically does not reach the CSF. A subdural hematoma over the brain surface results from a tear of bridging veins.

7. A 45-year-old, previously healthy man has developed headaches over the past month. There are no remarkable findings on physical examination. A cerebral MR angiogram shows a 7-mm saccular aneurysm at the trifurcation of the right middle cerebral artery. Which of the following is the most likely complication from this lesion?
   A. Cerebellar tonsillar herniation
   B. Hydrocephalus
   C. Epidural hematoma
   D. Subarachnoid hemorrhage
   E. Subdural hematoma

D. Intracranial aneurysms are typically saccular and enlarge slowly over time. Aneurysms that grow to 4 to 7 mm are at the greatest risk of rupture. Rupture occurs into the subarachnoid space at the base of the brain, where the cerebral arterial distribution originates around the circle of Willis, and where saccular aneurysms are most likely to arise. Neither a berry aneurysm nor the bleeding that results is likely to cause a mass effect and herniation. In some cases of survival after rupture of a berry aneurysm, a noncommunicating hydrocephalus results from organization of the subarachnoid hemor- rhage occluding foramina of Luschka and Magendie. Epidural hematomas arise from a tear of the middle meningeal artery, typically as a result of head trauma. Trauma also can cause a tear of bridging veins that produces a subdural hematoma.

8. A 19-year-old man has a sore throat followed a day later by sudden onset of a severe headache. Physical examination shows mild pharyngitis and nuchal rigidity. His skin shows petechial hemorrhages. His temperature is 38.8° C, pulse is 98/min, respirations are 26/min, and blood pressure is 95/45 mm Hg. The figure shows the representative gross appearance of the surface of his brain. Which of the following infectious organisms is most likely to have produced his disease?



A. *Cryptococcus neoformans*
B. *Mycobacterium tuberculosis*
C. *Neisseria meningitidis*
D. Poliovirus
E. *Toxoplasma gondii*

C. Acute meningitis, with a purulent exudate on the cerebral convexities shown in the gure, is indicative of bacterial infection. At his age, a common etiologic agent is Neisseria meningitidis, initially presenting as pharyngitis, and untreated proceeding to Waterhouse-Friderichsen syndrome with disseminated intravascular coagulopathy. Cryptococcosis should be considered in immunocompromised patients, but some cases occur in immunocompetent patients; a meningoencephalitis can occur. Tuberculous meningitis does not manifest so acutely, and the exudate is typically on the base of the brain. Poliomyelitis could occur after pharyn- gitis, but onset is insidious, with increasing paralysis from loss of motor neurons. It does not cause meningitis. Cerebral toxoplasmosis may occur in immunocompromised patients, but the lesions are parenchymal abscesses, not meningitis

9. A 44-year-old woman who is an intravenous drug user is admitted to the hospital with increasing headache and high fever for the past 24 hours. On physical examination, her temperature is 38.4° C, pulse is 85/min, respirations are 18/min, and blood pressure is 125/85 mm Hg. CT scan of the head shows no mass lesion or midline shift. A lumbar puncture is performed. The CSF shows 70,000 neutrophils/mm^3, an increased protein concentration, and a decreased glucose level. Which of the following infectious agents is most likely to produce these findings?

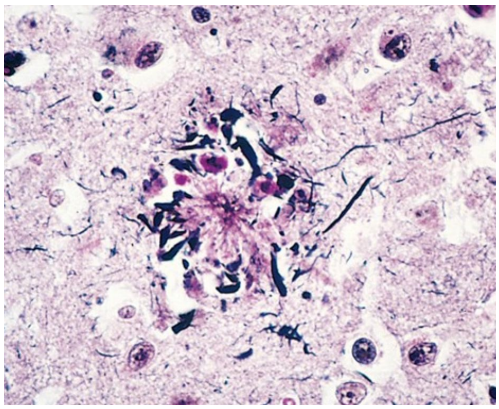
A. Herpes simplex virus
B. JC polyomavirus
C. *Mycobacterium tuberculosis*
D. *Staphylococcus aureus*
E. *Toxoplasma gondii*

D. Headache, fever, pronounced neutrophilia, a high CSF protein level, and a low glucose concentration all point to bacterial meningitis. Staphylococcus aureus is a common infection among injection drug users. Herpes simplex virus produces encephalitis, not meningitis. Tuberculous meningitis has a more insidious onset. This patient does not have a mass lesion of toxoplasmosis or focal lesions of progressive multifocal leukoencephalopathy (PML) that may be associ- ated with AIDS. PML is associated with the JC polyomavirus. Toxoplasmosis, which may occur in immunocompromised patients, produces parenchymal abscesses, not meningitis.

10. A 4-year-old girl residing near Cape Town, South Africa, has had worsening headache and irritability for the past week, and now exhibits nausea, vomiting, and diminished responsiveness to verbal commands. On examination she has a temperature of 37.2° C. A tremor is observed in her extremities. Her eyes do not move laterally. A lumbar puncture is performed and examination of the CSF shows 100 leukocytes/mm^3, and 75% of them mononuclears. The CSF glucose is decreased, but the protein is markedly elevated. CT imaging with enhancement shows basilar meningeal thickening and a focal 2-cm mass involving the right cerebellar hemisphere. Which of the following infectious agents is most likely to produce these findings?
    A. Coxsackie virus B
    B. *Haemophilus influenzae*
    C. *Mycobacterium tuberculosis*
    D. *Treponema pallidum*
    E. *Taenia solium*

C. Tuberculous meningitis is a complication of disseminated tuberculosis, and young children are at increased risk in locations where tuberculosis is prevalent. It tends to produce a more chronic course. Cranial nerves, such as the abducens in this case, can be involved. A large granulomatous mass, a tuberculoma, may complicate some cases. Viral "aseptic" meningitis is marked by mononuclear cells, but the protein is not usually markedly elevated, and no mass develops. Bacterial meningitis is often associated with a low glucose, but not a mass, and the in ammatory response is predominantly polymorphonuclear. T. pallidum is the causative agent for neurosyphilis with a long, insidious course and no mass effect. T. solium can lead to cysticercosis, with cystic masses in the brain

11. A study is conducted of patients who had increased phosphorylated tau and decreased Aβ peptide in their CSF 5 to 10 years prior to death at ages ranging from 55 to 80 years. At autopsy their brain weights are less than normal for age and body size. On gross examination, these brains show hydrocephalus ex vacuo and cortical atrophy but no focal lesions. The figure shows the high power microscopic appearance of cerebral neocortex with Bielschowsky silver stain. Which of the following symptoms is most likely to be recorded in the medical histories of these patients?



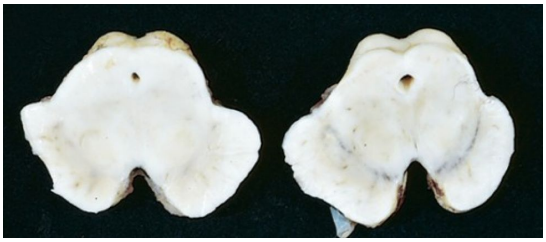
    A. Choreiform movements
    B. Gait disturbances
    C. Grand mal seizures
    D. Progressive memory loss
    E. Symmetric muscular weakness

D. The gure shows a neuritic plaque with a rim of dystrophic neurites surrounding an amyloid core consistent with Alzheimer disease (AD), the most common form of progressive dementia. AD is marked by increased numbers of microscopic neuritic plaques and neurofibrillary tangles compared to controls for age. Choreiform movements suggest Huntington disease. Gait disturbances occur in Parkinson disease. Seizures are associated with many lesions, but often a pathologic ending is not discernible. Symmetric muscular weakness suggests amyotrophic lateral sclerosis.

12. A 68-year-old woman with a 7-year history of progressive dementia dies of bronchopneumonia. At autopsy, there is cerebral atrophy in a predominantly frontal and parietal lobe distribution. Microscopic examination of the brain shows numerous neuritic plaques in the hippocampus, amygdala, and neocortex. Neurofibrillary tangles in the hippocampus contain tau protein. Congo red staining shows amyloid in the media of the small peripheral cerebral arteries. Which of the following genetic abnormalities is the most important factor in the development of her disease?
    A. Expansion of CAG repeats on chromosome 4p16
    B. HLA-DR3/DR4 alleles
    C. Increased tandem repeats in the *FMR1* gene
    D. Mutation of a prion protein gene
    E. Presence of the e4 allele at the *ApoE* gene

E. The clinical history of dementia and the presence of numerous neuritic plaques and amyloid deposition in blood vessel walls are characteristic of Alzheimer disease (AD). The e4 allele of the ApoE4 gene increases the risk of developing AD by unknown mechanisms. Expansion of CAG repeats on chromosome 4p16 causes Huntington disease. There is no association between HLA genes and AD. Increased repeats in the FMR1 gene occur with fragile X syndrome. Mutant prion genes give rise to spongiform encephalopathies, such as Creutzfeldt-Jakob disease.

13. A 55-year-old man has had increasing difficulty with initiation of voluntary movements and increasing inability to perform activities of daily living for 1 year. On physical examination, he has difficulty initiating movement, but he can keep moving if he follows someone walking ahead of him. He has an expressionless facies. The left side of the figure shows the gross appearance of the midbrain of this patient; on the right is a section through normal midbrain. What additional clinical feature is most closely associated with this abnormality?
    A. Ataxia with ambulation
    B. Choreiform movement
    C. Loss of short-term memory
    D. Symmetric weakness in the extremities
    E. Tremor at rest



E. Loss of pigmented dopaminergic neurons in the substantia nigra of the midbrain is most characteristic of Parkinson disease. Pill-rolling tremors at rest are typical of this disorder. A variety of genetic abnormalities have been associated with forms of Parkinson disease, including α-synuclein, parkin, DJ-1, and PINK1 gene mutations and mitochondrial dysfunction. Ataxia suggests a disruption in the motor control pathways, such as the cerebellum, or proprioception, from dorsal spinal cord columns. Choreiform movements suggest Huntington disease, which affects the caudate, not the substantia nigra. Short-term memory problems suggest hippocampal lesions. Symmetric weakness suggests a motor neuron disease.