BONUS STUDY PACKAGE

Bonus Question Bank

Clinical Textbook of Neuroradiology
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This bank contains 300 board-style questions, ten for each of the 30 chapters, none repeated from the book. Each question has one best answer. Answers, explanations, and the principle each question tests are collected at the back, chapter by chapter, so a chapter can be answered in one sitting and scored afterward.

The same questions run as a timed practice test, with tutor and exam modes and a score report by chapter, on the practice test page of the bonus site.

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PART I · CHAPTER 1

Imaging Techniques, Contrast, and Safety

B1.1

A 72-year-old man on anticoagulation fell and has a headache. The emergency physician reviews only the brain window of the noncontrast head CT and finds no blood. The neuroradiologist is asked whether the review is complete. Which response is correct?

A. Review subdural and bone windows too
B. The brain window alone is sufficient for trauma
C. Add contrast before any further window review
D. Only a bone window is needed after a fall
E. Repeat the CT with thicker sections first

B1.2

A quality committee compares head CT radiation doses across four hospitals and finds that the same examination type delivers very different doses. A radiologist on the committee is asked what published data showed about this variation. Which statement is accurate?

A. Doses were identical when the same scanner was used
B. Variation was under 10% for routine head CT
C. Only pediatric studies showed any variation
D. Variation reflected patient size and nothing else
E. Dose varied about 13-fold within types

B1.3

A 69-year-old woman undergoes thrombectomy for a middle cerebral artery occlusion. CT the next morning shows a hyperdense area in the treated basal ganglia, and the stroke team must decide whether to start antithrombotic therapy. Which technique best separates contrast staining from hemorrhage?

A. Repeat single-energy CT at 1 hour
B. CT angiography source images only
C. Plain skull radiographs of the region
D. Dual-energy CT material maps
E. Ultrasound through the temporal window

B1.4

A 66-year-old man has several dark foci on susceptibility-weighted images in the cortex and white matter. The neurosurgeon asks whether the apparent size of these foci reflects the true size of the blood deposits. Which response is correct?

A. They are measured exactly as they appear
B. They appear smaller than their true size
C. Blooming makes them look larger
D. Size depends only on gadolinium dose
E. They represent calcium and never blood

B1.5

A 70-year-old woman has an eGFR of 24 mL/min/1.73 m2 and is not on dialysis. She needs a contrast-enhanced CT of the head and neck for suspected abscess. The referring team asks whether saline prophylaxis is indicated. What do current consensus statements suggest?

A. Prophylaxis is never indicated for intravenous contrast

B. Prophylaxis is indicated at this eGFR

C. Contrast is contraindicated at any eGFR below 60

D. Dialysis must be scheduled after the scan

E. Prophylaxis applies only to intra-arterial injection

B1.6

A 63-year-old man with chronic kidney disease and an eGFR of 22 needs contrast-enhanced MRI for a suspected brain metastasis. The nephrologist worries about nephrogenic systemic fibrosis. What does published evidence show for group II gadolinium agents at this level of function?

A. No cases in 4931 administrations

B. Risk near 10% after one injection

C. Risk equal to group I linear agents

D. Cases in most patients on dialysis

E. Absolute contraindication below eGFR 30

B1.7

A 45-year-old woman with relapsing multiple sclerosis has undergone more than twenty contrast-enhanced MRI examinations over a decade. Precontrast T1-weighted images now show symmetric high signal in both dentate nuclei, and her kidney function has always been normal. Which explanation is most likely?

A. Hemorrhage in the cerebellar nuclei

B. Manganese deposition from liver disease

C. Calcification from hypoparathyroidism

D. Normal finding at her age

E. Gadolinium retention from prior doses

B1.8

A hospital porter is about to wheel a patient on a transport gurney with an oxygen cylinder through the door of the MRI scanner room. A technologist stops him. Under the four-zone safety model, which zone is the room he was about to enter?

A. Zone I, the public area

B. Zone II, the screening area

C. Zone IV

D. Zone III, the controlled corridor

E. No zone, because the magnet is off

B1.9

A department moves its brain tumor protocol from a 1.5 T to a 3 T scanner to improve small lesion detection. A physicist warns that some image artifacts will become more prominent. Which artifact change is expected at 3 T?

A. Less chemical shift at fat interfaces
B. More artifact near metal
C. No change in radiofrequency heating
D. Disappearance of motion ghosting
E. Lower signal than at 1.5 T

B1.10

A medical student asks why diffusion-weighted MRI shows acute infarction earlier than T2-weighted images. The neuroradiologist cites early experimental work in ischemic brain. What did that work show about timing?

A. T2 change appeared before diffusion change
B. Both changed together after 24 hours
C. Diffusion change appeared only after 6 hours
D. Diffusion change appeared at 45 minutes
E. Neither changed during the first day

PART I · CHAPTER 2

Neuroanatomy, Normal Variants, and the Search Pattern

B2.1

A first-year resident must identify the central sulcus on axial MRI to localize a small lesion near the motor cortex. The attending describes a landmark where one frontal sulcus meets another at a right angle. Which landmark is used?

A. Superior frontal and precentral sulcus junction
B. Junction of the calcarine and parieto-occipital sulci
C. Meeting point of the cingulate and callosal sulci
D. Junction of the Sylvian fissure and the insula
E. Junction of the lateral ventricle and caudate head

B2.2

A 70-year-old man has slowly progressive gait change. CT shows enlarged lateral ventricles while the cortical sulci appear normal in size. The neurologist asks what this proportion suggests. Which interpretation is best?

A. Generalized cerebral atrophy for age
B. Hydrocephalus rather than volume loss
C. Normal aging without further concern
D. Bilateral middle cerebral artery infarcts
E. Diffuse cerebral edema from hypoxia

B2.3

A neuroradiology fellow is reviewing time-of-flight MR angiography in healthy volunteers for a research project. The supervisor asks how often the circle of Willis is entirely complete in adults. Which figure is supported by published data?

A. In 95% of volunteers
B. In 75% of volunteers
C. In 5% of volunteers
D. In 42% of volunteers
E. In every healthy adult

B2.4

A 68-year-old man with a severe right internal carotid stenosis has transient left arm weakness. Diffusion MRI shows a row of small acute infarcts in the right centrum semiovale, lined up in the deep white matter parallel to the lateral ventricle. Which mechanism does this distribution most strongly suggest?

A. Cardioembolism to several cortical branches
B. Lacunar disease of one perforating artery
C. Hypoperfusion distal to the stenosis
D. Venous infarction from sinus thrombosis
E. Vasculitis of medium-sized cortical arteries

B2.5

A 59-year-old man has round foci in the basal ganglia that follow cerebrospinal fluid signal on T1-weighted, T2-weighted, and FLAIR images without enhancement or restricted diffusion. Which structures do they represent?

A. Lacunar infarcts
B. Demyelinating plaques
C. Cystic metastases
D. Neurocysticercosis cysts
E. Perivascular spaces

B2.6

A population-based MRI study of older adults reported the frequency of incidental findings. A public health researcher asks how often asymptomatic brain infarcts were found. Which figure was reported in the Rotterdam Study?

A. 0.1%
B. 7.2%
C. 1.6%
D. 1.8%
E. 32%

B2.7

A 35-year-old woman has a 7 mm pineal cyst with fluid signal and a thin rim on MRI performed for migraine. She is anxious and asks what usually happens to such cysts over time. Which statement reflects published data?

A. Most grow and need surgery
B. Half become pineal tumors
C. Most cause hydrocephalus within a year
D. All require yearly MRI for life
E. Most stay stable or shrink

B2.8

A new resident starting overnight call asks for a reliable order of review for a noncontrast head CT so that small subdural collections, fractures, and incidental findings are not missed. Which sequence of review is recommended?

A. Bone, then brain, then stop
B. Margins first, then brain only
C. Brain window only, then the report
D. Brain, subdural, bone, then margins
E. Subdural window, then the scout image only

B2.9

A 41-year-old woman has MRI requested to exclude a cerebellopontine angle mass because of hearing loss. The study is normal apart from two small perivascular spaces and a small pineal cyst. Where should the answer to the requested question appear?

A. In the opening lines
B. After a list of every variant
C. Only in an addendum
D. At the end after recommendations
E. Nowhere, because the study is normal

B2.10

A 47-year-old woman with a large right temporal hematoma becomes drowsy. Repeat CT shows that the right ambient cistern is narrower than the left, while the midline shift is unchanged and the basal cisterns are otherwise visible. What does the cistern asymmetry most likely indicate?

A. Normal asymmetry of the perimesencephalic cisterns
B. Communicating hydrocephalus from blood
C. Early uncal herniation
D. Subarachnoid extension from the hematoma alone
E. Tonsillar herniation through the foramen magnum

PART II • CHAPTER 3

Acute Ischemic Stroke and Imaging for Reperfusion

B3.1

A 34-year-old woman has sudden right arm weakness and speech arrest that began with jerking of the right hand. Noncontrast CT and CT angiography are normal, and her glucose is low normal after treatment by paramedics. The stroke team asks which conclusion the normal CT supports. Which response is correct?

A. Infarction is excluded by the normal CT
B. Hemorrhage must be present on repeat CT
C. Thrombolysis is contraindicated by the normal CT
D. Large vessel occlusion is confirmed
E. A mimic remains possible

B3.2

A center with a rapidly available MRI scanner wants to use MRI rather than CT as the first study in suspected stroke. The quality lead asks which hemorrhage-related advantage MRI offers over CT. Which statement is accurate?

A. It shows microbleeds CT misses
B. It cannot detect acute hemorrhage
C. It needs no safety screening
D. It is always faster than CT
E. It ignores lesion age entirely

B3.3

A 77-year-old man with left hemiparesis has an old right frontal infarct and confluent periventricular white matter change on CT, plus new subtle hypoattenuation in the right insula. A resident counts all low-density areas when calculating ASPECTS. What is the correct approach?

A. Count every low-density region present
B. Count chronic infarcts but not small vessel change
C. Count only regions on the asymptomatic side
D. Count only new hypoattenuation or swelling
E. Count periventricular change as two regions

B3.4

A 64-year-old woman has CT ASPECTS of 8 and diffusion-weighted MRI 30 minutes later that gives a diffusion ASPECTS of 6. The neurologist asks whether the infarct has grown rapidly. Which explanation is most likely?

A. The CT was misread in every region
B. Diffusion shows more ischemic tissue
C. The infarct tripled within half an hour
D. Diffusion underestimates the core
E. The two scores are interchangeable

B3.5

A 51-year-old man has an acute left M1 occlusion on CT angiography. The left cervical internal carotid artery shows a flame-shaped tapering just above its origin with no calcified plaque. The interventional team asks what this cervical finding suggests. Which interpretation is best?

A. Atherosclerotic stenosis of the bulb
B. Normal carotid bulb asymmetry
C. Dissection with a tandem lesion
D. Fibromuscular dysplasia of the vertebral artery
E. Carotid web with distal thrombus only

B3.6

A 70-year-old woman with a right M1 occlusion has single-phase CT angiography showing sparse filling of pial branches beyond the occlusion compared with the left side. The neurologist asks how collateral status affects prognosis. Which statement is correct?

A. Collaterals are graded without comparison
B. Sparse filling guarantees a good outcome
C. Collateral status has no prognostic value
D. Collaterals are graded only on noncontrast CT
E. Abundant pial filling is favorable

B3.7

An automated CT perfusion platform reports an ischemic core and a hypoperfused volume in a patient with M1 occlusion. A fellow asks which thresholds commonly define these regions on CT perfusion. Which pair is typical?

A. Tmax over 2 s and CBF under 80%
B. CBV over 6 mL and Tmax under 30 s
C. MTT under 1 s and CBF over 90%
D. Tmax over 6 s and CBF under 30%
E. Tmax over 30 s and CBF under 6%

B3.8

A 59-year-old man has fluctuating consciousness, vertigo, and diplopia over several hours, without a clear hemiparesis. Noncontrast CT is normal. A quick review of CT angiography focused on the middle cerebral arteries is reported as negative. Which vessel must be specifically checked?

A. The basilar artery
B. The anterior communicating artery
C. The external carotid artery
D. The middle meningeal artery
E. The superficial temporal artery

B3.9

A 62-year-old woman wakes with aphasia, last seen well 8 hours earlier, and automated perfusion shows a small core with a large hypoperfused region but no large vessel occlusion. The neurologist asks which trial supports considering thrombolysis in this setting. Which trial applies?

A. DAWN

B. EXTEND

C. ATTENTION

D. RESCUE-Japan LIMIT

E. BAOCHE

B3.10

A 69-year-old man has a distal M2 occlusion on CT angiography, and a colleague drafts a report saying only that there is a middle cerebral artery occlusion. Why does the attending ask for the segment to be named precisely?

A. Segment naming has no effect on treatment

B. Only the side of occlusion matters

C. M1 and M2 differ in expectations

D. Distal occlusions are never treated

E. Naming segments delays thrombolysis

PART II · CHAPTER 4

Stroke Mechanisms, Small Vessel Disease, and Stroke Mimics

B4.1

A 66-year-old man has a pure motor hemiparesis, a classic lacunar syndrome. Diffusion MRI shows three small acute cortical lesions in the left frontal and parietal lobes and no subcortical infarct. How should the mechanism be framed in the report?

A. Small vessel disease, because the syndrome is lacunar
B. A chronic lacune with no acute lesion
C. Watershed infarction from hypotension
D. Embolism rather than small vessel disease
E. Venous infarction from sinus thrombosis

B4.2

A 72-year-old woman with a recent anterior myocardial infarction has acute cortical infarcts in two territories. Her stroke CT angiogram includes a delayed acquisition through the heart. Which finding on that acquisition is most relevant?

A. Left ventricular apical thrombus
B. Calcified mitral annulus without thrombus
C. Mild pericardial thickening
D. A small hiatal hernia
E. Coronary artery calcification alone

B4.3

A 70-year-old man has a 9 mm round fluid-filled cavity in the left putamen with a thin rim of FLAIR hyperintensity and no diffusion restriction. A previous MRI 2 years ago showed an acute lesion at the same site. What is the correct term for the present lesion?

A. Recent small subcortical infarct
B. Lacune
C. Enlarged perivascular space
D. Acute lacunar hemorrhage
E. Cystic metastasis

B4.4

A 78-year-old woman with atrial fibrillation is being considered for anticoagulation. Susceptibility-weighted MRI shows several strictly lobar microbleeds in the occipital and parietal cortex and none in the deep gray matter. Which underlying disorder does this distribution suggest?

A. Hypertensive arteriopathy
B. Diffuse axonal injury
C. Cavernous malformation syndrome
D. Septic emboli from endocarditis
E. Cerebral amyloid angiopathy

B4.5

A 63-year-old man has posterior circulation transient ischemic attacks. Neck CT angiography covers the carotid bifurcations well, but the field of view barely includes the subclavian arteries. Which commonly missed lesion should the neuroradiologist look for?

A. Carotid bulb web
B. Basilar tip aneurysm
C. Vertebral origin stenosis
D. External carotid occlusion
E. Jugular bulb dehiscence

B4.6

A 57-year-old woman has a stenosis of the left middle cerebral artery M1 segment. Diffusion MRI shows a small infarct at the origin of lenticulostriate branches and several small lesions in the deep border zone beyond the stenosis. Which mechanism best explains this combination?

A. Cardioembolism from atrial fibrillation
B. Cerebral venous thrombosis
C. Reversible vasoconstriction syndrome
D. Intracranial atherosclerosis
E. Migraine with aura

B4.7

A 38-year-old woman has a cortical infarct with no stenosis, no cardiac source on monitoring, and normal vessels. The neurologist asks what imaging contributes to assessing a patent foramen ovale. Which statement is correct?

A. Brain MRI directly shows the foramen
B. Neck CT angiography confirms the shunt
C. Brain MRI cannot show the shunt itself
D. Diffusion imaging measures the shunt size
E. Perfusion imaging proves paradoxical embolism

B4.8

A 55-year-old man has acute aphasia and fever. MRI shows diffusion abnormality in the left temporal lobe that also involves the insula and cingulate gyrus, resembling a posterior middle cerebral infarct. Which diagnosis should be considered as a mimic?

A. Lacunar infarct of the internal capsule
B. Hypertensive putaminal hemorrhage
C. Posterior reversible encephalopathy
D. Venous infarction of the vertex
E. Herpes simplex encephalitis

B4.9

A 68-year-old woman is admitted with new agitation and confusion but no focal weakness, and a urinary infection is suspected. The neurologist still requests MRI. Which stroke location can present this way as a chameleon?

A. A right hemisphere or thalamic infarct
B. A small left occipital infarct
C. A cervical cord infarct
D. An optic nerve infarct
E. A pontine lacune with typical hemiparesis

B4.10

A 60-year-old man had 30 minutes of right hand weakness that fully resolved. MRI performed the next day shows a small focus of restricted diffusion in the left precentral gyrus. How does this finding change the classification?

A. It confirms a transient ischemic attack
B. It becomes a minor stroke
C. It excludes a vascular cause
D. It indicates an old infarct only
E. It has no effect on recurrence risk

PART II · CHAPTER 5

Intracerebral Hemorrhage and Cerebral Microbleeds

B5.1

A 61-year-old man has a left thalamic hemorrhage with blood in the ventricles. Follow-up CT 8 hours later shows blood layering in the occipital horns. The neurosurgeon asks where early hydrocephalus is best judged. Which ventricular feature should be assessed?

A. The septum pellucidum thickness
B. The fourth ventricle shape alone
C. The occipital horn blood level only
D. The size of the cisterna magna
E. The temporal horns

B5.2

A 66-year-old woman with a right putaminal hemorrhage has noncontrast CT showing a sharply marginated junction between a hypodense and a hyperdense part of the hematoma. The neurologist asks what this sign represents. Which name and meaning are correct?

A. Blend sign of mixed-age blood
B. Swirl sign of calcification
C. Black hole sign of an aneurysm
D. Satellite sign of metastasis
E. Spot sign seen without contrast

B5.3

A 70-year-old man had a 22 mL lobar hematoma on admission CT. A second CT at 18 hours measures 31 mL. The team asks whether this meets the usual study definition of hematoma growth. Which response is correct?

A. No, growth requires doubling of volume
B. No, growth is defined only by new symptoms
C. Yes, because any change counts
D. Yes, more than 6 mL absolute increase
E. No, a second CT cannot define growth

B5.4

A 45-year-old woman without hypertension has a lobar hemorrhage. Early CT angiography is normal. The neurologist asks whether further vascular imaging is worthwhile. What did a prospective multicenter study show about the yield of a structured search?

A. No causes beyond CT angiography
B. A cause in fewer than 1%
C. A macrovascular cause in 23%
D. Tumors in most patients
E. Aneurysms in half of patients

B5.5

A 58-year-old man has a 3 cm left frontal hematoma with surrounding edema disproportionate to its size and a rim of enhancing tissue on delayed contrast-enhanced MRI. He has a history of renal cell carcinoma. Which diagnosis is most likely?

A. Hypertensive hemorrhage
B. Hemorrhagic metastasis
C. Hemorrhagic transformation of an infarct
D. Amyloid angiopathy hemorrhage
E. Coagulopathic hemorrhage

B5.6

A 74-year-old woman has a 3.5 cm right cerebellar hematoma and is drowsy. The neurosurgeon asks what the CT report must describe because of the risk of rapid deterioration. Which feature is most important?

A. The exact Hounsfield unit of the clot
B. The thickness of the occipital bone
C. Calcification of the falx
D. Fourth ventricle compression
E. Size of both frontal sinuses

B5.7

A 79-year-old man has recurrent brief episodes of tingling that spread up his left arm over minutes. MRI shows linear hypointensity along the surface of several right parietal gyri on susceptibility-weighted images. What is the finding called?

A. Cortical laminar necrosis
B. Cortical superficial siderosis
C. Leptomeningeal carcinomatosis
D. Gyral calcification of Sturge-Weber
E. Venous congestion from a fistula

B5.8

A 67-year-old woman has several round dark foci on susceptibility-weighted images. One dark structure follows a linear course across three adjacent slices, and another is bright on CT. How should these two be classified?

A. Both as definite microbleeds
B. Both as cavernous malformations
C. Both as hemorrhagic metastases
D. Both as artifacts from the sinuses
E. As mimics, not microbleeds

B5.9

A 76-year-old man presenting with lobar hemorrhage has MRI showing both lobar and deep microbleeds in the thalami. The stroke neurologist asks how to describe the underlying small vessel disease. Which description fits?

A. Mixed small vessel disease

B. Pure amyloid angiopathy

C. Pure hypertensive arteriopathy

D. Cerebral vasculitis

E. Diffuse axonal injury

B5.10

A 55-year-old woman with sudden headache has a small parenchymal hemorrhage that is subtle on CT. MRI is obtained with a short stroke protocol. Why is a susceptibility-weighted sequence included?

A. It measures perfusion without contrast

B. It is insensitive to old hemorrhage

C. Blood products are paramagnetic

D. It replaces diffusion imaging

E. It shows only calcium deposits

PART II · CHAPTER 6

Subarachnoid Hemorrhage and Intracranial Aneurysms

B6.1

A 53-year-old woman has a thunderclap headache. CT shows subarachnoid blood concentrated in the interhemispheric fissure with a small clot in the gyrus rectus. The neurointerventionalist asks where to look first on CT angiography. Which artery is the most likely site of the aneurysm?

A. Basilar tip
B. Left middle cerebral bifurcation
C. Posterior inferior cerebellar artery
D. Ophthalmic segment of the carotid
E. Anterior communicating artery

B6.2

A 44-year-old woman had a sudden severe headache 8 days ago and now has a normal CT. MRI shows FLAIR sulcal hyperintensity over both hemispheres. She received propofol for sedation during the scan. How should the FLAIR finding be interpreted?

A. Diagnostic of subarachnoid hemorrhage
B. Nonspecific; other causes exist
C. Diagnostic of bacterial meningitis
D. An artifact that never mimics blood
E. Proof of reversible vasoconstriction

B6.3

A 49-year-old man with aneurysmal subarachnoid hemorrhage is on day 7 after treatment and develops new aphasia. The neurocritical care team asks which imaging combination best evaluates the likely cause at this stage. Which approach fits?

A. Noncontrast CT alone at 1 week
B. MR spectroscopy of the frontal lobe
C. CT angiography with CT perfusion
D. Lumbar puncture for xanthochromia
E. Plain radiographs of the coil

B6.4

A 60-year-old woman with subarachnoid hemorrhage from an untreated posterior communicating aneurysm suddenly deteriorates 5 hours after admission. CT shows more blood and new intraventricular extension. Which complication is most likely?

A. Delayed cerebral ischemia from vasospasm
B. Communicating hydrocephalus alone
C. Hyponatremic brain edema
D. Aneurysm rebleeding
E. Contrast staining from angiography

B6.5

A neurosurgeon reviewing CT angiography of a ruptured middle cerebral bifurcation aneurysm asks what the report should include to plan coiling or clipping. Which set of features is most useful?

A. Dome, neck, ratio, and branches
B. Only the maximal diameter of the dome
C. Only the side and the parent artery
D. Bone density of the skull base
E. Hounsfield units of the clot

B6.6

A 57-year-old woman had coiling of a basilar tip aneurysm 6 months ago. Follow-up imaging is planned to look for recanalization at the neck. Which modality shows residual flow with the least artifact from the coil mass?

A. CT angiography
B. Noncontrast CT
C. Plain skull radiographs
D. MR angiography with contrast
E. Ultrasound through the temporal bone

B6.7

A 38-year-old man who injects drugs has fever and a new murmur. CT angiography shows a small aneurysm on a distal cortical branch of the right middle cerebral artery that was not visible 2 weeks ago. Which type of aneurysm is most likely?

A. Saccular berry aneurysm
B. Traumatic pseudoaneurysm
C. Mycotic aneurysm
D. Fusiform atherosclerotic aneurysm
E. Blister aneurysm of the carotid

B6.8

A 64-year-old patient asks about the risk that an unruptured aneurysm found incidentally will bleed. A pooled analysis of prospective cohorts is cited. What was the mean observed 5-year risk of rupture?

A. 0.1%
B. 3.4%
C. 15%
D. 30%
E. 50%

B6.9

A 70-year-old woman has headache, and CT shows blood in three sulci over the left convexity, with normal basal cisterns. MRI shows several lobar microbleeds. Which cause is most likely at her age?

A. Ruptured anterior communicating aneurysm
B. Perimesencephalic venous bleeding
C. Pituitary apoplexy
D. Traumatic contusion of the temporal pole
E. Cerebral amyloid angiopathy

B6.10

A 46-year-old man with subarachnoid hemorrhage arrives drowsy. The neurosurgeon asks what scales, in addition to the modified Fisher grade, are recorded to frame prognosis and urgency. Which pair is used?

A. Hunt and Hess and WFNS
B. ASPECTS and NIHSS
C. ICH score and GCS alone
D. Fazekas and Koedam
E. Bern and Knosp

PART II • CHAPTER 7

Vascular Malformations

B7.1

A 32-year-old woman has an unruptured arteriovenous malformation in the left frontal lobe. Catheter angiography shows a 6 mm aneurysm on a feeding artery and a single draining vein with a stenosis. What should the report add beside the surgical grade?

A. Hemorrhage risk features
B. Nothing beyond the grade
C. Only the nidus diameter
D. Only the patient's age
E. The bone density of the skull

B7.2

A 29-year-old man with an arteriovenous malformation near the left motor cortex is being evaluated for surgery. The neurosurgeon asks which imaging tools refine the judgment of eloquence before treatment. Which combination applies?

A. Noncontrast CT and skull radiographs
B. Ultrasound and plain films
C. Perfusion CT alone
D. Functional MRI and tractography
E. PET with amyloid tracers alone

B7.3

A 63-year-old man has a dural arteriovenous fistula of the transverse sinus. MRI shows dilated cortical veins on susceptibility images and white matter edema in the adjacent temporal lobe. What does this pattern indicate?

A. A benign fistula with antegrade flow only
B. Normal venous anatomy
C. A cavernous malformation
D. Low-grade glioma
E. Cortical venous drainage

B7.4

A 58-year-old woman has a red right eye and diplopia without trauma. Orbital MRI shows an enlarged right superior ophthalmic vein, mild proptosis, and enlarged extraocular muscles. Which diagnosis is most likely?

A. Direct high-flow traumatic carotid fistula
B. Thyroid eye disease alone
C. Indirect dural cavernous fistula
D. Orbital lymphoma
E. Optic nerve sheath meningioma

B7.5

A 39-year-old woman with a family history of seizures has several cavernous malformations on susceptibility MRI. She asks whether more lesions are likely to appear. What did prospective follow-up of affected families show?

A. No new lesions ever form
B. New lesions appeared over time
C. All lesions disappear spontaneously
D. Lesions convert to aneurysms
E. Lesions become tumors

B7.6

A 27-year-old man treated with cranial radiation for medulloblastoma at age 8 now has several small foci of susceptibility signal loss in the irradiated field. Which explanation is most likely?

A. Recurrent medulloblastoma in the field
B. Radiation-induced cavernomas
C. Hemorrhagic metastases
D. Amyloid angiopathy
E. Diffuse axonal injury

B7.7

A 47-year-old woman has an acute hemorrhage in the right frontal white matter. MRI shows a cavernous malformation at the hemorrhage site and an adjacent developmental venous anomaly. Which lesion most likely bled?

A. The cavernous malformation
B. The developmental venous anomaly
C. Both equally
D. Neither; it is hypertensive
E. A hidden glioma

B7.8

A 51-year-old man had stereotactic radiosurgery for an arteriovenous malformation 18 months ago. MRI now shows edema and enhancement around the treated nidus without new hemorrhage. How should these changes be reported?

A. As recurrent malformation
B. As a new glioma
C. As a cerebral abscess
D. As venous thrombosis
E. As treatment effects

B7.9

A 70-year-old man has slowly progressive leg weakness. Thoracic MRI shows a long segment of central cord T2 hyperintensity with flow voids along the dorsal surface of the cord. Which vascular malformation does this suggest?

A. Cavernous malformation of the cord
B. Capillary telangiectasia
C. Developmental venous anomaly
D. Spinal dural fistula
E. Carotid-cavernous fistula

B7.10

A 33-year-old woman has a small lesion in the pons that is invisible on T2-weighted images, enhances faintly in a brushlike pattern, and loses signal on susceptibility images without hemosiderin. Why does it lose signal on susceptibility imaging?

A. Hemosiderin from prior hemorrhage
B. Calcification in the lesion
C. Deoxyhemoglobin in slow flow
D. Melanin pigment
E. Metal from a prior procedure

PART II • CHAPTER 8

Dissection, Vasculopathy, and Cerebral Venous Thrombosis

B8.1

A 41-year-old man has neck pain after chiropractic manipulation and a lateral medullary infarct. CT angiography shows irregular narrowing of the left vertebral artery where it loops around the atlas. Which segment is involved?

A. V1
B. V2
C. V4
D. V3
E. The basilar tip

B8.2

A 47-year-old woman with a known carotid dissection has follow-up CT angiography at 4 months. The lumen has largely recanalized, but a stable 5 mm pseudoaneurysm persists. The neurologist asks how such pseudoaneurysms are usually managed. Which response is correct?

A. All require urgent stenting
B. Most are left alone
C. All require open surgical repair
D. They predict imminent rupture
E. They require lifelong anticoagulation

B8.3

A 52-year-old woman has a cervical internal carotid dissection. CT angiography also shows alternating narrowing and dilation of the mid cervical internal carotid and vertebral arteries, away from the bifurcations. Which condition explains these findings?

A. Atherosclerosis of the bifurcation
B. Takayasu arteritis of the arch
C. Multifocal fibromuscular dysplasia
D. Moyamoya disease
E. Reversible vasoconstriction syndrome

B8.4

A 46-year-old man has headaches, cognitive decline, and infarcts of different ages. Vessel wall MRI shows smooth concentric wall thickening with intense enhancement in several arteries in different territories. Which diagnosis is favored?

A. Vasculitis
B. Intracranial atherosclerosis
C. Reversible vasoconstriction
D. Single intracranial dissection
E. Normal vessel walls

B8.5

A 64-year-old woman with a recent middle cerebral artery occlusion has vessel wall MRI showing enhancement of the occluded segment. A colleague calls this vasculitis. Which limitation of vessel wall imaging applies?

A. Wall imaging has no artifacts
B. Slow flow never mimics enhancement
C. Arteries are large relative to voxels
D. Precontrast images are unnecessary
E. Enhancement can follow thrombus

B8.6

A 55-year-old woman with subarachnoid hemorrhage has three intracranial aneurysms on angiography, and the bleeding pattern does not clearly identify the source. Which vessel wall finding has been associated with instability?

A. Calcification of every aneurysm
B. Enhancement of one aneurysm wall
C. Absence of a defined neck in all
D. Equal size of all three aneurysms
E. Thrombus in the parent artery

B8.7

A 33-year-old woman 1 week post partum has severe headaches and a hypertensive crisis. MRI shows parieto-occipital vasogenic edema, and MR angiography shows segmental narrowing of several arteries. How should the imaging be approached?

A. Image the arteries only
B. Image the parenchyma only
C. Image both parenchyma and arteries
D. Avoid MRI in the postpartum state
E. Treat as primary angiitis without imaging

B8.8

A 7-year-old girl has recurrent episodes of arm weakness triggered by crying. MRI shows multiple small flow voids in the basal ganglia and narrowing of both distal internal carotid arteries. In adults with the same disease, which presentation is more common?

A. Ischemia triggered by hyperventilation
B. Seizures from cortical dysplasia
C. Progressive dementia only
D. Hemorrhage from fragile collaterals
E. Isolated headache without lesions

B8.9

A 28-year-old woman taking oral contraceptives has headache. Contrast-enhanced CT shows a triangular filling defect in the posterior superior sagittal sinus surrounded by enhancing dura. What is this sign called?

A. Empty delta sign
B. Dense triangle sign
C. Cord sign
D. String of beads sign
E. Ivy sign

B8.10

A 31-year-old woman with cerebral venous thrombosis of the superior sagittal sinus has a small parasagittal hemorrhage and is now stable on anticoagulation. She asks about her likely long-term outcome. What did a large international cohort report?

A. Most died within a month
B. Most were severely dependent
C. None recovered fully
D. Outcome was uniformly poor with hemorrhage
E. Most had no symptoms at follow-up

PART III · CHAPTER 9

Traumatic Brain Injury

B9.1

A night resident drafts a trauma head CT report that begins with an incidental sinus finding and mentions the subdural collection last. The attending asks for the standard order. Which item comes first in a trauma head CT report?

A. Incidental sinus disease
B. Fractures of the facial bones
C. Extra-axial collections
D. The state of the mastoid air cells
E. Comparison with an old dental film

B9.2

An 81-year-old man on apixaban has 3 weeks of confusion after a minor fall he barely remembers. CT shows a mixed-density crescentic collection with septations and layering of different densities over the left hemisphere. What predisposes him to this lesion?

A. Arterial rupture of the middle meningeal artery
B. Atrophy stretching bridging veins
C. Dural sinus thrombosis
D. Spontaneous subarachnoid hemorrhage
E. Skull fracture across a suture

B9.3

A 63-year-old man is found collapsed in the street with a scalp laceration. CT shows subarachnoid blood filling the basal cisterns symmetrically, with no contusions. The emergency physician assumes traumatic hemorrhage. What should the report recommend?

A. No further imaging
B. Repeat CT in 1 week
C. MRI of the cervical spine only
D. Skull radiographs
E. CT angiography for an aneurysm

B9.4

A 25-year-old man has multiple superficial wedge-shaped areas of mixed blood and edema in both inferior frontal lobes and the left temporal pole after a fall. A large left temporal lesion is present. Why is the temporal lesion watched closely?

A. Risk of uncal herniation
B. Temporal lesions never expand
C. Frontal lesions alone cause herniation
D. Contusions are always single round clots
E. Temporal contusions are artifacts

B9.5

A 19-year-old woman remains in a coma 2 days after a high-speed motorcycle crash, but her admission CT shows only a small hemorrhage in the splenium of the corpus callosum. Which mechanism best explains her condition?

A. Direct impact at the vertex only
B. Arterial dissection of both carotids
C. Cerebral venous thrombosis
D. Rotational shear of axons
E. Hypoglycemia from injury

B9.6

A 30-year-old man has headaches and poor concentration 3 months after a mild head injury, and both CT and MRI are normal. His lawyer requests diffusion tensor imaging to prove injury. How should the radiologist describe the role of such techniques?

A. Diagnostic in individual patients
B. Replacements for conventional MRI
C. Research and group comparisons
D. Required in every concussion
E. Proof of injury when abnormal

B9.7

A 22-year-old man with a severe head injury is monitored with serial CT. The neurosurgeon asks which finding best tracks dangerous intracranial pressure on follow-up imaging. Which finding is most useful?

A. Calcification of the choroid plexus
B. Effacement of the basal cisterns
C. Opacification of the mastoids
D. Size of the cisterna magna alone
E. Thickness of the scalp hematoma

B9.8

A 34-year-old man has clear fluid dripping from his nose after a frontal impact. CT shows a fracture through the posterior wall of the frontal sinus and the cribriform plate. Which complication should the report mention?

A. Facial nerve palsy
B. Carotid artery injury in the clivus
C. Ossicular disruption
D. Vertebral artery dissection
E. A route for CSF leak and meningitis

B9.9

A 27-year-old man has a gunshot wound to the head. CT shows a linear hemorrhagic tract with fragments that cross the midline and pass through the lateral ventricles. Which statement about these findings is correct?

A. They predict a poor outcome
B. They predict full recovery
C. They indicate a superficial injury
D. They exclude vascular injury
E. They require no further imaging

B9.10

A 36-year-old woman was in a car crash and has a seatbelt abrasion across the neck and a Le Fort II facial fracture, but no neurological deficit. Which imaging should be added to her trauma CT?

A. Lumbar spine MRI
B. Abdominal ultrasound only
C. Skull radiographs
D. Neck CT angiography
E. Brain perfusion SPECT

PART III · CHAPTER 10

Herniation, Hypoxic-Ischemic Injury, and Death by Neurologic Criteria

B10.1

A 58-year-old man with a right frontal hematoma becomes less responsive. Repeat CT is reviewed for the earliest sign of descending transtentorial herniation before the midbrain moves. Which finding appears first?

A. Widening of the ipsilateral ambient cistern
B. Hemorrhage in the pons
C. Upward displacement of the vermis
D. Effacement of the ipsilateral cisterns
E. Enlargement of the fourth ventricle

B10.2

A 47-year-old woman with massive cerebral edema after a hemorrhage deteriorates further, and CT shows small linear hemorrhages in the central pons and midbrain. What are these hemorrhages called, and what causes them?

A. Kernohan notch hemorrhages
B. Shear hemorrhages from axonal injury
C. Duret hemorrhages
D. Contusions from a direct impact
E. Venous hemorrhages from sinus thrombosis

B10.3

A 52-year-old woman underwent a large right decompressive craniectomy. Follow-up CT shows swollen brain bulging through the defect with a new hemorrhagic infarct at its margin. What mechanism explains the infarct?

A. Arterial embolism from the carotid
B. Hypertensive small vessel rupture
C. Radiation injury at the margin
D. Infection of the bone flap
E. Kinked veins at the margin

B10.4

A 66-year-old man remains comatose 3 days after an out-of-hospital cardiac arrest, and his noncontrast CT is unremarkable. The intensive care team requests MRI. Which sequence is most sensitive in this early period for hypoxic-ischemic injury?

A. Noncontrast CT
B. Diffusion-weighted imaging
C. Time-of-flight angiography
D. Postcontrast T1-weighted imaging
E. Susceptibility-weighted imaging

B10.5

A term neonate had a difficult delivery, and conventional MRI on day 2 is equivocal. The neonatologist asks which additional technique can help establish hypoxic-ischemic injury. Which finding supports the diagnosis?

A. A lactate peak on spectroscopy
B. Normal N-acetylaspartate levels
C. A choline-only peak
D. Absence of all metabolites
E. Lipid peak from scalp fat only

B10.6

A 59-year-old man is comatose 2 days after cardiac arrest. Noncontrast CT shows diffuse loss of gray-white differentiation. The intensivist asks how this can be quantified. Which measure is used?

A. Midline shift at the pineal gland
B. Size of the lateral ventricles
C. Gray to white matter attenuation ratio
D. Thickness of the cortex in millimeters
E. Count of microbleeds

B10.7

A 64-year-old woman is comatose after cardiac arrest and is receiving targeted temperature management with sedation. MRI shows restricted diffusion in the occipital cortex and basal ganglia. How should the report handle prognosis?

A. Describe injury and confounders
B. Declare a hopeless prognosis
C. Omit the deep gray matter findings
D. State that sedation invalidates the MRI
E. Recommend withdrawal of care

B10.8

A 33-year-old man is found confused in a house with a faulty gas heater, and his partner has headache. MRI shows symmetric restricted diffusion in both globi pallidi. Which exposure does this pattern classically indicate?

A. Methanol
B. Inhaled heroin vapor
C. Metronidazole
D. Carbon monoxide
E. Lithium

B10.9

A 45-year-old woman with catastrophic brain injury is being evaluated for death by neurologic criteria, and the clinical examination cannot be completed. Radionuclide perfusion scintigraphy is performed. Which pattern supports absent cerebral blood flow?

A. Uptake in both cerebral hemispheres
B. Uptake in the cerebellum only
C. Increased cortical uptake
D. Normal uptake with delayed washout
E. Empty skull with a hot nose

B10.10

A CT angiogram is performed as an ancillary test, and the proximal middle cerebral arteries opacify faintly while the cortical branches and internal cerebral veins do not fill. A resident calls this preserved flow. Which interpretation is correct?

A. Normal flow in every territory
B. Stasis filling only
C. A technical failure only
D. Venous sinus thrombosis
E. Arterial vasospasm

PART IV · CHAPTER 11

Adult Gliomas and the WHO Classification

B11.1

A 71-year-old man has a nonenhancing infiltrative lesion in the left temporal lobe with restricted diffusion and high relative cerebral blood volume. A resident drafts a report calling it a low-grade glioma because it does not enhance. What is wrong with that conclusion?

A. Nonenhancing tumors are always benign
B. Diffusion has no role in gliomas
C. Perfusion excludes high-grade tumor
D. Only children have nonenhancing gliomas
E. It may already be glioblastoma

B11.2

A 19-year-old man has 3 months of morning headaches and progressive ataxia. MRI shows a large right cerebellar cyst with an intensely enhancing mural nodule and little surrounding edema. Which tumor is most likely?

A. Diffuse midline glioma
B. Glioblastoma, IDH-wildtype
C. Pilocytic astrocytoma
D. Oligodendroglioma
E. Central neurocytoma

B11.3

A 38-year-old woman has a cortical-based frontal lesion that expands gyri, enhances patchily, and shows high relative cerebral blood volume. Biopsy shows a grade 2 oligodendroglioma. Why can a low-grade oligodendroglioma look like this?

A. Dense capillary network
B. Necrosis from rapid growth
C. Coexisting abscess
D. Hemorrhage from an aneurysm
E. Leptomeningeal spread

B11.4

A 63-year-old woman has a ring-enhancing mass crossing the genu of the corpus callosum into both frontal lobes, with central necrosis and surrounding FLAIR signal. What term describes this spread pattern?

A. Dawson finger pattern
B. Butterfly pattern
C. Salt-and-pepper pattern
D. Tram-track pattern
E. Trident pattern

B11.5

A 55-year-old man with glioblastoma develops new back pain and leg weakness 14 months after diagnosis. Brain MRI shows thin enhancement along the ventricular walls. What should the report recommend?

A. No further imaging
B. Chest radiograph only
C. Bone scintigraphy
D. Spine MRI with contrast
E. Carotid duplex ultrasound

B11.6

A 42-year-old woman with a nonenhancing frontal glioma is referred to a center that offers tailored spectroscopy. The neurosurgeon asks what specific metabolite can indicate the IDH mutation noninvasively. Which metabolite is it?

A. N-acetylaspartate
B. Creatine and phosphocreatine
C. Myo-inositol
D. Glutamine and glutamate
E. 2-hydroxyglutarate

B11.7

A 60-year-old man had subtotal resection of a right temporal glioblastoma yesterday and is recovering well. The neurosurgeon asks when the postoperative MRI should be obtained to measure the extent of resection accurately. Which timing is ideal?

A. After 3 weeks
B. After 3 months
C. Only before radiotherapy planning
D. Within 48 to 72 hours
E. Only if symptoms appear

B11.8

Six weeks after glioblastoma resection, MRI shows new enhancement around the cavity in a region that showed restricted diffusion on the day-2 postoperative study. How should this enhancement be interpreted?

A. Definite early recurrence
B. Evolving surgical injury
C. A new second primary tumor
D. Radiation necrosis at 6 weeks
E. An abscess in the cavity

B11.9

A 47-year-old man has a large left frontal glioma abutting the precentral gyrus, and awake surgery with intraoperative mapping is planned. What should the preoperative imaging report state about functional anatomy?

A. Relation to motor tracts
B. The thickness of the skull
C. The size of the frontal sinus
D. The position of the pineal gland
E. The density of the falx

B11.10

A 52-year-old man with treated glioblastoma has surveillance MRI. Which perfusion technique is described with leakage correction to give relative cerebral blood volume maps that guide biopsy toward the most aggressive region?

A. Arterial spin labeling only
B. Dynamic contrast-enhanced permeability
C. Dynamic susceptibility contrast
D. Time-of-flight angiography
E. Phase-contrast flow imaging

PART IV · CHAPTER 12

Meningiomas and Other Extra-Axial Tumors

B12.1

A 68-year-old woman with treated breast cancer has a new 2 cm dural-based mass over the right parietal convexity with a dural tail and erosion of the adjacent bone. Two smaller dural nodules are present elsewhere. Which diagnosis must be favored over meningioma?

A. Typical meningioma
B. Arachnoid cyst
C. Dural metastases
D. Epidermoid cyst
E. Hemangioblastoma

B12.2

A 59-year-old man has an olfactory groove meningioma measuring 5 cm that was found only after his partner noticed personality change. Why can tumors at this site reach a large size before diagnosis?

A. They compress the chiasm early
B. They cause early hearing loss
C. They always bleed at presentation
D. They obstruct the aqueduct first
E. They grow large before symptoms

B12.3

A 47-year-old woman has proptosis on the left. CT shows thickened sclerotic bone of the left greater sphenoid wing with a thin sheet of enhancing dural tissue on MRI. Which form of meningioma fits?

A. En plaque meningioma
B. Olfactory groove meningioma
C. Intraventricular meningioma
D. Tuberculum sellae meningioma
E. Cerebellopontine angle meningioma

B12.4

A 64-year-old man had a meningioma treated with radiosurgery 1 year ago. Follow-up MRI shows the tumor unchanged in size with decreased enhancement and a small central nonenhancing area. How should these changes be described?

A. Definite tumor progression
B. Transformation to a malignant grade
C. Abscess formation
D. An expected treatment response
E. Radiation-induced glioma

B12.5

A 34-year-old woman treated with cranial irradiation for childhood leukemia now has three meningiomas, one of which shows invasion of the adjacent brain. How does her prior irradiation relate to these findings?

A. It prevents meningioma formation
B. It raises incidence and grade
C. It causes only arachnoid cysts
D. It affects only the spine
E. It has no relation to meningioma

B12.6

A 52-year-old man has a dumbbell-shaped mass spanning the middle and posterior cranial fossae through Meckel cave, with cystic change and no calcification. Facial numbness is present. Which diagnosis is most likely?

A. Petroclival meningioma
B. Epidermoid cyst
C. Chordoma
D. Trigeminal schwannoma
E. Arachnoid cyst

B12.7

A 23-year-old woman has sudden headache with brief loss of consciousness when she bends forward. CT shows a small round hyperdense mass at the foramen of Monro with mild enlargement of both lateral ventricles. Which lesion is most likely?

A. Colloid cyst
B. Neurenteric cyst
C. Choroid fissure cyst
D. Arachnoid cyst of the ventricle
E. Pineal region cyst

B12.8

A 44-year-old man has a meningioma that has been followed for 6 years. Measurements vary between reports because one radiologist uses the maximal diameter and another uses two perpendicular diameters. How should surveillance be reported?

A. A different method on each study
B. Same method each time
C. Only a qualitative description
D. Only the largest diameter on any plane
E. Only the dural tail length

B12.9

A 66-year-old man has a 3 cm convexity meningioma with irregular, mushrooming margins, heterogeneous enhancement with necrosis, and restricted diffusion in its solid part. Which conclusion about grade is most appropriate?

A. Grade is settled as benign
B. Imaging proves grade 3
C. Higher grade is suggested
D. Necrosis excludes meningioma
E. Diffusion is irrelevant to grade

B12.10

A 58-year-old woman has a thick, smooth dural enhancement along the tentorium and falx, with similar thickening of the dura over both convexities. She has hilar adenopathy. Which group of diseases should the report consider?

A. Multiple meningiomas of NF2
B. Arachnoid cysts
C. Epidermoid cysts
D. Hemangioblastomas
E. Sarcoidosis or IgG4 disease

PART IV · CHAPTER 13

Brain Metastases, Lymphoma, and Leptomeningeal Disease

B13.1

A 62-year-old woman with melanoma has a new hemorrhagic lesion in the right frontal lobe and two smaller lesions. A resident asks which primary tumors commonly produce hemorrhagic brain metastases. Which group is correct?

A. Prostate, bladder, and colon carcinoma
B. Lymphoma, leukemia, and myeloma
C. Breast, ovary, and cervix carcinoma
D. Melanoma and renal carcinoma
E. Pancreas, stomach, and esophagus carcinoma

B13.2

A neuroradiologist reviews a postcontrast gradient-echo 3D T1-weighted study and sees several tiny punctate enhancing dots that could be small vessels or metastases. Which sequence choice helps suppress small vessel signal that mimics tiny lesions?

A. Thicker 2D gradient-echo slices
B. Noncontrast FLAIR only
C. Spin-echo based 3D T1
D. Diffusion-weighted imaging
E. Time-of-flight angiography

B13.3

A 57-year-old man with lung cancer has a 2.5 cm right cerebellar metastasis with surrounding edema. The radiation oncologist asks what the report should state about this location. Which feature is most important?

A. The exact Hounsfield unit of the lesion
B. The thickness of the occipital bone
C. Calcification of the falx
D. Size of the mastoid air cells
E. Effect on the fourth ventricle

B13.4

A 60-year-old woman with one resected brain metastasis and no systemic therapy options is asymptomatic after surgery. The tumor board asks which postoperative radiation approach the ASCO, SNO, and ASTRO guideline recommends. Which option fits?

A. Whole-brain radiotherapy without memantine
B. Radiosurgery to the cavity
C. Observation with no radiation
D. Chemotherapy alone
E. Repeat resection at 3 months

B13.5

A 64-year-old woman treated with radiosurgery alone for three metastases has stable treated lesions at 3 months but a new 4 mm lesion elsewhere. The oncologist asks whether this was expected. Which tradeoff of radiosurgery alone explains it?

A. Better cognition, more new lesions
B. Worse cognition with fewer lesions
C. Longer survival with more lesions
D. No difference in intracranial control
E. Fewer lesions and better cognition

B13.6

A 66-year-old man with EGFR-mutant lung cancer has several small brain metastases that shrink after starting a targeted drug, without radiation. The neuroradiologist asks what this means for follow-up imaging. Which practice is most important?

A. Stop imaging once lesions shrink
B. Use a different protocol each time
C. Measure on comparable sequences
D. Report only new lesions, not size
E. Image only when symptoms occur

B13.7

A 65-year-old woman has a homogeneously enhancing periventricular mass that is hyperdense on noncontrast CT and restricts diffusion on MRI. A colleague asks why primary central nervous system lymphoma is often dense on CT. Which explanation is correct?

A. Calcification within the tumor
B. Acute hemorrhage in every case
C. Fat content of the tumor
D. High cellularity
E. Contrast from a prior study

B13.8

A 70-year-old man is newly diagnosed with primary central nervous system lymphoma by stereotactic biopsy. The hematologist asks which staging steps are needed beyond brain MRI. Which set is appropriate?

A. Brain MRI alone is sufficient
B. Skull radiographs and bone scan
C. Carotid ultrasound and echocardiogram
D. Spine radiographs only
E. Eyes, CSF, and body

B13.9

A 52-year-old woman with breast cancer had a lumbar puncture yesterday because of headache. Today's MRI shows smooth, thick dural enhancement over both convexities. How should the enhancement be interpreted?

A. Definite leptomeningeal metastasis
B. Possibly from the lumbar puncture
C. Bacterial meningitis
D. Subarachnoid hemorrhage
E. Normal finding that needs no comment

B13.10

A 56-year-old man with lymphoma has new systemic relapse and a facial nerve palsy. MRI shows enhancement of the facial nerve and dura without a parenchymal mass. Which form of central nervous system involvement is this?

A. Secondary involvement
B. Primary parenchymal lymphoma
C. Glioblastoma
D. Tumefactive demyelination
E. Pyogenic abscess

PART IV · CHAPTER 14

Treatment Response and Treatment Effects

B14.1

A 54-year-old man with glioblastoma has a cystic resection cavity with a thin enhancing wall and an 8 mm enhancing nodule in its wall. The trial coordinator asks which part is measured under RANO. Which response is correct?

A. The entire cyst wall diameter
B. The cavity including fluid
C. Nothing, because cavities are never assessed
D. The surrounding FLAIR signal only
E. Only a qualifying nodular component

B14.2

A 45-year-old woman with glioblastoma had MRI on a different scanner, with a different FLAIR sequence and oblique slices, and the tumor appears larger. The neuro-oncologist asks whether this proves growth. Which response is most appropriate?

A. Yes, any larger measurement proves growth
B. No change can ever be measured
C. Technique differences may explain it
D. Only CT can compare tumors
E. Size cannot be followed after surgery

B14.3

A 58-year-old man with glioblastoma has a steroid increase for headache. Three days later MRI shows reduced enhancement. The neuro-oncologist asks whether this is a tumor response. Which interpretation is correct?

A. It confirms a partial response
B. Steroids may reduce enhancement
C. It proves pseudoprogression
D. It indicates radiation necrosis
E. It is caused by contrast dose error

B14.4

A 49-year-old man with IDH wild-type glioblastoma has stable enhancement but increasing FLAIR signal crossing the corpus callosum with mass effect. RANO 2.0 no longer evaluates nonenhancing disease in this tumor type outside antiangiogenic therapy. Should the change be reported?

A. No, FLAIR is never relevant
B. No, it is always treatment effect
C. Only if enhancement also increases
D. Yes, it can be early growth
E. Only on CT, not MRI

B14.5

A 60-year-old woman had two courses of radiosurgery to the same brain metastasis. The lesion is now enlarging with edema. Which factor in her history most increases the likelihood of radiation necrosis?

A. Retreatment of the same lesion
B. Female sex
C. A small treated volume
D. A single fraction to a distant site
E. Absence of systemic therapy

B14.6

A 55-year-old man has a treated metastasis with an enlarging enhancing lesion. On T2-weighted images, a hypointense margin closely matches the area of enhancement. Which diagnosis does this feature favor?

A. Recurrent tumor
B. New abscess
C. Hemorrhagic metastasis
D. Radiation necrosis
E. Tumefactive demyelination

B14.7

A 62-year-old woman with recurrent glioma has single-voxel spectroscopy placed next to the resection cavity and the frontal sinus. The spectrum is noisy and uninterpretable. What explains the poor spectrum?

A. Too little choline in all tumors
B. Voxel placement near air and cavities
C. Normal brain has no metabolites
D. Spectroscopy cannot be used after surgery
E. The patient received corticosteroids

B14.8

A 63-year-old man has suspected recurrent glioma. FDG PET is equivocal because a small lesion lies next to the cortex. Why does amino acid PET show recurrent glioma more clearly?

A. Low uptake in normal brain
B. Higher uptake in normal cortex
C. It shows only blood flow
D. It requires no tracer
E. It measures diffusion

B14.9

A 57-year-old woman with melanoma had radiosurgery to two metastases and is receiving immunotherapy. One treated lesion is growing while another untreated lesion shrinks. How should the report describe this?

A. Call it uniform progression
B. Call it uniform response
C. Report each lesion separately
D. Report only the largest lesion
E. Ignore lesions treated with radiation

B14.10

A 48-year-old man with IDH wild-type glioblastoma has a 30% increase in enhancement along the cavity 6 weeks after completing chemoradiotherapy, and he is clinically stable. Which tumor characteristic increases the likelihood that this is pseudoprogression?

A. IDH wild-type status alone
B. Location in the occipital lobe
C. Absence of edema
D. Male sex
E. MGMT promoter methylation

PART IV · CHAPTER 15

Sellar, Parasellar, and Pineal Region Masses

B15.1

A 17-year-old girl has headaches, and MRI shows a pituitary gland 9 mm tall with an upward convex margin and homogeneous enhancement. She has no endocrine symptoms. How should the gland be described?

A. Macroadenoma with chiasm compression
B. Within normal limits for her age
C. Lymphocytic hypophysitis
D. Pituitary apoplexy
E. Rathke cleft cyst

B15.2

A 44-year-old man has a thickened pituitary stalk and absence of the posterior pituitary bright spot on T1-weighted images, with new polyuria and thirst over several weeks. What does this combination suggest?

A. A normal anatomical variant needing no follow-up
B. Pituitary macroadenoma
C. Rathke cleft cyst
D. Empty sella
E. A hypothalamic or infundibular disorder

B15.3

A 50-year-old woman has a 2.5 cm sellar and suprasellar mass that contains coarse calcification on CT. A colleague calls it a pituitary macroadenoma. Which feature argues most against that diagnosis?

A. Expansion of the sella
B. A waist at the diaphragma sellae
C. Calcification
D. Lower enhancement than normal gland
E. Displacement of the chiasm

B15.4

A 46-year-old woman has a pituitary incidentaloma that was found on CT. The endocrinologist asks which tests the Endocrine Society guideline recommends for every patient with an incidentaloma. Which set applies?

A. MRI only with no blood tests
B. Biopsy of every lesion before any follow-up
C. Petrosal sinus sampling in all
D. History, examination, hormone screening
E. Radiotherapy planning CT

B15.5

A 52-year-old woman with a 7 mm pituitary microincidentaloma found on a head CT asks how often such lesions grow. What did pooled follow-up data show for microincidentalomas compared with macroincidentalomas during surveillance?

A. 10.6% grew versus 24%
B. Most grew within a year
C. None grew during follow-up
D. Microlesions grew more often
E. Both grew in about half

B15.6

A 35-year-old woman with a prolactinoma on dopamine agonist therapy has follow-up MRI showing a smaller tumor with new cystic change and a small area of hemorrhage. The endocrinologist asks whether this indicates treatment failure. Which response is correct?

A. Proof of acquired dopamine agonist resistance
B. An indication for urgent surgery
C. Common during treatment, not failure
D. A sign of malignant change
E. Evidence of a second tumor

B15.7

A 61-year-old man has a large sellar mass and a prolactin level that seems disproportionately low for a tumor of that size. The endocrinologist suspects an assay problem. What should the report mention?

A. The mass cannot be a pituitary tumor
B. Prolactin is irrelevant to imaging
C. Low prolactin excludes hypersecretion
D. Possible assay saturation
E. The tumor must be a meningioma

B15.8

A 55-year-old man has a solid suprasellar mass within the third ventricle without calcification or cysts. Molecular testing of the resected tissue shows a BRAF V600E mutation. Which tumor is it?

A. Adamantinomatous craniopharyngioma
B. Papillary craniopharyngioma
C. Pituitary macroadenoma
D. Germinoma
E. Pilocytic astrocytoma

B15.9

A 63-year-old man has a thickened pituitary stalk without a pituitary mass, and the posterior pituitary bright spot is absent. The radiologist lists possible causes. Which group is the appropriate adult differential?

A. Hypophysitis, sarcoidosis, metastasis, lymphoma
B. Germinoma and Langerhans cell histiocytosis only
C. Normal anatomical variants needing no workup
D. Pituitary adenoma alone in all adult patients
E. Rathke cleft cyst only

B15.10

A 22-year-old woman has a pineal region mass with obstructive hydrocephalus and headache worsening over 2 days. The neurosurgeon asks what the report must state besides the mass description. Which feature is most urgent?

A. The age of pineal calcification
B. Thickness of the falx
C. Size of the cisterna magna
D. Signal of the sphenoid marrow
E. Hydrocephalus and its severity

PART V · CHAPTER 16

Intracranial Infection

B16.1

A 24-year-old man with bacterial meningitis has worsening confusion on day 4. MRI shows ependymal enhancement of the lateral ventricles with layering debris in the occipital horns that restricts diffusion. Which complication is present?

A. Subdural effusion
B. Cerebral venous thrombosis
C. Choroid plexus papilloma
D. Ventriculitis
E. Normal postinfectious change

B16.2

A 6-year-old child recovering from pneumococcal meningitis develops new right-sided hemiparesis. MRI shows acute infarcts in the basal ganglia and thalami. What is the most likely mechanism of these infarcts?

A. Cardioembolism from endocarditis
B. Hypertensive small vessel disease
C. Venous infarction from a dural fistula
D. Watershed hypoperfusion from dehydration
E. Involvement of perforating arteries

B16.3

A 15-year-old boy with meningitis has opacified frontal sinuses on MRI. The neurosurgeon asks which sinus finding would identify a source that may need surgical drainage. Which finding should the report seek?

A. Mucosal thickening of the maxillary sinus
B. A breached posterior frontal sinus wall
C. A retention cyst in the sphenoid sinus
D. Concha bullosa of the middle turbinate
E. Septal deviation to the right side

B16.4

A 48-year-old man has a ring-enhancing lesion in the frontal lobe. MR spectroscopy of the cavity is performed to distinguish abscess from necrotic tumor. Which spectral finding favors a pyogenic abscess over a necrotic tumor?

A. Elevated choline in the enhancing rim and cavity
B. A high myo-inositol peak alone
C. Amino acids, acetate, and succinate
D. Elevated N-acetylaspartate
E. A normal spectrum throughout

B16.5

A 33-year-old woman has several small ring-enhancing abscesses at the gray-white junction in both hemispheres, without sinus or ear disease and with no recent neurosurgery. What additional evaluation should the report recommend?

A. Echocardiography or pulmonary AVM search
B. Repeat MRI in 1 year only
C. Stereotactic biopsy of every lesion
D. Sinus CT alone with no further testing done
E. Serum tumor markers only

B16.6

A 57-year-old woman with fever and confusion has asymmetric T2 and FLAIR hyperintensity in the medial temporal lobe and insula. A resident suggests middle cerebral artery infarction. Which finding favors herpes simplex encephalitis?

A. Restricted diffusion
B. Sparing of the basal ganglia
C. Involvement of the left side
D. Gyral swelling
E. Hyperintensity on FLAIR

B16.7

A 30-year-old traveler returning from Asia has fever and decreased consciousness. MRI shows T2 hyperintensity in both thalami, the basal ganglia, and the brainstem. Which viral infection does this distribution suggest?

A. Japanese encephalitis
B. Herpes simplex encephalitis
C. Varicella zoster vasculopathy
D. Enterovirus 71 rhombencephalitis
E. HIV encephalopathy

B16.8

A 46-year-old man with poorly controlled diabetes and ketoacidosis has sinus disease, orbital swelling, proptosis,, and a hemorrhagic frontal infarct on MRI. Which group of organisms best explains these findings?

A. Cryptococcus
B. Candida
C. Toxoplasma
D. Nocardia
E. Mucorales

B16.9

A 29-year-old woman with seizures has a single calcified nodule in the frontal cortex with surrounding edema on MRI. Serology suggests prior cysticercosis. What stage of neurocysticercosis does this lesion represent?

A. Viable cyst with scolex
B. Colloidal stage
C. End stage calcified nodule
D. Racemose subarachnoid cyst
E. Granular nodular stage only

B16.10

A 62-year-old man had a craniotomy 3 months ago. MRI shows enhancement of the dura and bone flap margins without a collection. The clinician asks whether this indicates infection. What is the best interpretation?

A. Definite bone flap osteomyelitis needing removal
B. Subdural empyema
C. Recurrent tumor
D. Expected postoperative enhancement
E. Ventriculitis

PART V · CHAPTER 17

Multiple Sclerosis

B17.1

A 52-year-old woman with a single episode of transient numbness has several small deep white matter foci without typical shape or location. She has hypertension. Which reporting approach is most appropriate?

A. State that findings meet MS criteria
B. Name multiple sclerosis as the leading possible cause
C. Neutral description without suggesting demyelination
D. Recommend immediate disease-modifying therapy
E. Report the lesions as definite plaques

B17.2

A neurologist asks why juxtacortical lesions involving the U fibers favor multiple sclerosis over small vessel ischemic disease in a 40-year-old patient with new sensory symptoms. Which anatomical explanation is correct?

A. U fibers have a dual blood supply
B. U fibers lack myelin
C. U fibers drain to deep veins
D. U fibers are supplied by perforators
E. U fibers are absent in adults

B17.3

A 34-year-old woman has a cervical cord lesion on MRI. The neurologist asks which axial appearance is typical of a multiple sclerosis lesion rather than another myelopathy. Which description fits best?

A. Central, involving the whole cord area
B. H-shaped gray matter involvement
C. Dorsal columns over many segments
D. Wedge shaped, under half the cord area
E. Ring of enhancement with a central cyst

B17.4

A 29-year-old man has a 3 cm white matter lesion with an incomplete ring of enhancement open toward the cortex. The differential includes tumor and abscess. Which diagnosis does the open ring favor?

A. Glioblastoma with central necrosis
B. Tumefactive demyelination
C. Pyogenic abscess
D. Metastasis
E. Lymphoma

B17.5

A 41-year-old woman with multiple sclerosis has an enhancing lesion on MRI. Her neurologist asks how long enhancement in a new demyelinating lesion usually lasts. What is the typical duration?

A. 1 to 3 days
B. 6 to 12 months in most lesions
C. Several years
D. Permanently
E. 2 to 8 weeks, usually under 4

B17.6

A 37-year-old woman with multiple sclerosis has four lesions with a paramagnetic rim on susceptibility imaging. What did a cohort of 209 patients show about patients with four or more rim lesions?

A. Lower relapse rates over the following years
B. Complete lesion resolution
C. No difference in disability
D. Earlier motor and cognitive disability
E. Better response to treatment

B17.7

A 30-year-old woman with relapsing multiple sclerosis has follow-up MRI on a disease-modifying treatment. The neurologist asks which measure is the main indicator of disease activity during treatment. Which is it?

A. Total lesion volume estimate
B. Brain atrophy measurement
C. Number of black holes
D. Corpus callosum thickness
E. New or enlarging T2 lesions

B17.8

A 45-year-old man with multiple sclerosis on stable therapy asks whether his brain volume should be measured at each scan to track neurodegeneration. Why is atrophy measurement not routine in individual patients?

A. Atrophy does not occur in MS
B. It requires a PET study with a tracer
C. Confounded by hydration and steroids
D. It is identical to healthy aging
E. It cannot be seen on MRI

B17.9

A 27-year-old woman with incidental typical demyelinating lesions and no symptoms asks whether treatment matters for radiologically isolated syndrome. What did a randomized trial of 87 people show for dimethyl fumarate?

A. No effect on clinical events

B. Reduced risk of a first clinical event

C. Increased lesion formation

D. Reversal of existing lesions

E. Benefit appearing only after ten years

B17.10

A 35-year-old woman is evaluated for possible multiple sclerosis, and MRI shows rounded lesions in the central corpus callosum with hearing loss and branch retinal artery occlusions. Which diagnosis do these red flags suggest?

A. Susac syndrome

B. Multiple sclerosis

C. Neuromyelitis optica

D. Small vessel disease

E. Progressive multifocal leukoencephalopathy

PART V · CHAPTER 18

NMOSD, MOGAD, and Autoimmune Encephalitis

B18.1

A 38-year-old woman has a cervical cord lesion spanning four vertebral segments that extends into the medulla, with central cord involvement. Which disorder does this pattern most strongly suggest among demyelinating diseases?

A. Multiple sclerosis with typical short lesions
B. Spinal cord infarction from aortic surgery
C. Subacute combined degeneration of the cord
D. Neuromyelitis optica spectrum disorder
E. Radiation myelopathy after neck treatment

B18.2

A 31-year-old woman has acute visual loss and optic neuritis on orbital MRI. The neurologist asks which optic nerve appearance favors neuromyelitis optica spectrum disorder over multiple sclerosis. Which description fits?

A. Long, posterior, involving the chiasm
B. Short anterior segment with disc swelling
C. Isolated optic nerve sheath enhancement only
D. Unilateral lesion confined to the orbital apex
E. Normal nerve with isolated retinal changes

B18.3

A 26-year-old man with painful visual loss has bilateral anterior optic neuritis with optic disc swelling and enhancement of the optic nerve sheath and surrounding fat. Which antibody-associated disease do these features suggest?

A. Aquaporin-4 seropositive neuromyelitis optica
B. Anti-NMDA receptor encephalitis
C. MOG antibody-associated disease
D. Relapsing-remitting multiple sclerosis
E. Neurosarcoidosis of the optic chiasm

B18.4

A 22-year-old woman has a longitudinal spinal cord lesion that involves the conus medullaris, with fluffy poorly marginated brain lesions in the cerebellar peduncles. Which disorder best fits this combination?

A. Multiple sclerosis with typical plaques
B. MOG antibody-associated disease
C. Aquaporin-4 neuromyelitis optica spectrum
D. Spinal dural arteriovenous fistula
E. Vitamin B12 deficiency myelopathy

B18.5

A 7-year-old girl has encephalopathy after a viral illness, and MRI shows large bilateral asymmetric white and deep gray matter lesions, all enhancing together. What does the uniform enhancement suggest?

A. Lesions of widely differing ages
B. Chronic inactive plaques
C. Hemorrhagic transformation
D. An underlying tumor
E. Lesions of similar age

B18.6

An 8-year-old boy treated for acute disseminated encephalomyelitis 6 months ago has a follow-up MRI showing several new lesions. What does the appearance of new lesions at this stage suggest?

A. Expected evolution of a single episode
B. Contrast-related artifact on follow-up
C. Normal myelination in a growing child
D. An alternative or relapsing diagnosis
E. Response to corticosteroid treatment

B18.7

A 64-year-old man has subacute memory loss over 6 weeks and seizures with bilateral medial temporal FLAIR hyperintensity. Herpes simplex encephalitis is also being considered by the team. Which feature favors autoimmune limbic encephalitis?

A. Strong diffusion restriction throughout
B. Insular sparing without hemorrhage
C. Asymmetric insular cortex involvement
D. Petechial hemorrhage in the temporal lobe
E. Rapid onset with high fever

B18.8

A 68-year-old man with weeks of confusion has brief, frequent episodes of arm and face posturing, memory loss, and hyponatremia. MRI shows medial temporal FLAIR hyperintensity. Which antibody is most likely?

A. LGI1
B. GAD65
C. NMDA receptor
D. Aquaporin-4
E. MOG

B18.9

A 46-year-old woman has thick nodular leptomeningeal enhancement around the hypothalamus, infundibulum, and optic chiasm, with facial nerve enhancement. There is hilar lymphadenopathy on chest radiography. Which diagnosis best fits this pattern?

A. Herpes simplex encephalitis
B. Multiple sclerosis
C. Pituitary macroadenoma
D. Neuromyelitis optica
E. Neurosarcoidosis

B18.10

A 23-year-old woman has new psychosis, seizures, and confusion, and CSF studies are pending. MRI of the brain is normal. The clinician asks whether the normal MRI rules out encephalitis. Which statement is correct?

A. It excludes autoimmune encephalitis
B. It confirms a primary psychiatric illness
C. It keeps antibody testing indicated
D. It proves herpes simplex encephalitis
E. It means no further testing is needed

PART VI · CHAPTER 19

Dementia and Neurodegenerative Disease

B19.1

A 58-year-old woman has early-onset memory and visuospatial decline, and her hippocampi appear relatively preserved on MRI. The neurologist asks which visual rating scale best captures the expected atrophy in this setting. Which scale is it?

A. Fazekas white matter scale
B. Koedam posterior atrophy scale
C. Global cortical atrophy scale
D. Medial temporal atrophy scale
E. Evans index of ventricular size

B19.2

A 63-year-old man presents with difficulty reading, judging distances, and recognizing objects, with relatively preserved memory. MRI shows occipital and parietal atrophy. Which atypical presentation of Alzheimer disease fits these findings?

A. Posterior cortical atrophy
B. Logopenic progressive aphasia
C. Frontal variant Alzheimer disease
D. Behavioral variant frontotemporal dementia
E. Corticobasal degeneration syndrome

B19.3

A 74-year-old woman being evaluated for memory loss has multiple lobar microbleeds and cortical superficial siderosis on susceptibility-weighted imaging. Which underlying condition do these findings suggest and why does it matter?

A. Chronic hypertensive arteriopathy
B. Diffuse axonal injury
C. Cerebral amyloid angiopathy
D. Cavernous malformations
E. Normal aging changes

B19.4

A 71-year-old man receiving lecanemab has a surveillance MRI showing six new lobar microbleeds and a new area of superficial siderosis, with no FLAIR abnormality. How should these findings be classified?

A. ARIA-E
B. Posterior reversible encephalopathy
C. Hemorrhagic infarction
D. Diffuse axonal injury
E. ARIA-H

B19.5

A memory clinic at a regional hospital is setting up lecanemab treatment and asks when appropriate use recommendations advise surveillance MRI after the baseline study in eligible patients. Which schedule is recommended?

A. Only after the final infusion is given
B. Before every infusion for the first year
C. Only when new symptoms appear in patients
D. Before the 5th, 7th, and 14th infusions
E. Once yearly with no other routine scans

B19.6

A 70-year-old woman with Alzheimer disease who takes apixaban daily for atrial fibrillation is referred by her family physician to discuss starting lecanemab. Which statement reflects the appropriate use recommendations for anticoagulated patients?

A. They may receive it at a reduced dose
B. They need monthly MRI only
C. They require amyloid PET twice
D. They should not receive lecanemab
E. They are preferred candidates

B19.7

A 76-year-old man on anti-amyloid therapy has new cortical FLAIR hyperintensity in the right parietal lobe. A resident considers ARIA-E but also an acute infarct. Which finding favors infarction over ARIA-E?

A. Sulcal FLAIR hyperintensity alone
B. Restricted diffusion in the region
C. Absence of any new clinical symptoms
D. Location in the parietal cortex
E. Subcortical white matter swelling

B19.8

A 66-year-old woman has effortful, halting speech with grammatical errors and apraxia of speech. MRI shows focal atrophy. Which region is expected to be atrophic in the nonfluent or agrammatic variant of primary progressive aphasia?

A. Bilateral anterior temporal lobe cortex only
B. Left temporoparietal junction
C. Bilateral occipital cortex
D. Right medial temporal lobe
E. Left posterior frontal and insular cortex

B19.9

A 72-year-old man has fluctuating cognition and visual hallucinations. FDG PET shows occipital hypometabolism with relative preservation of the posterior cingulate. What is this preserved metabolism called and what does it suggest?

A. Cingulate island sign, Lewy body dementia
B. Hot cross bun sign, multiple system atrophy
C. Hummingbird sign, supranuclear palsy
D. Swallow tail sign, normal substantia nigra
E. Pulvinar sign, prion disease in adults

B19.10

A 61-year-old man has early parkinsonism with a normal conventional MRI. Susceptibility-weighted imaging at 3 T shows loss of the normal dorsolateral nigral hyperintensity. What does loss of this swallow tail sign suggest?

A. Normal aging only
B. Essential tremor
C. Degenerative parkinsonism
D. Drug-induced parkinsonism
E. Vascular parkinsonism

PART VI · CHAPTER 20

Toxic and Metabolic Encephalopathies

B20.1

A 34-year-old woman with eclampsia has seizures, and MRI shows vasogenic edema in the parietal and occipital lobes. The resident asks which three patterns of distribution are described in this syndrome. Which list is correct?

A. Parieto-occipital, cerebellar, and spinal cord only
B. Basal ganglia, thalamic, and periaqueductal patterns
C. Single vascular territory, watershed, and lacunar types
D. Parieto-occipital, watershed, superior frontal
E. Cortical ribbon, deep gray, and callosal splenium types

B20.2

A 49-year-old man with severe hypertension and PRES deteriorates, and CT shows marked cerebellar edema with compression of the fourth ventricle. Which outcome is this finding associated with in severe forms of the syndrome?

A. Obstructive hydrocephalus, brainstem compression
B. Spontaneous resolution with no added risk at all
C. Chronic demyelination of the corpus callosum
D. Isolated visual field loss without other risk
E. Delayed leukoencephalopathy after several weeks

B20.3

A 55-year-old man with chronic alcohol use has confusion, ataxia, and ophthalmoplegia. MRI shows symmetric medial thalamic and periaqueductal hyperintensity. Which additional sign is particularly useful in alcohol-related Wernicke encephalopathy?

A. Pulvinar restricted diffusion
B. Mammillary body enhancement
C. Hot cross bun sign in the pons
D. Putaminal hemorrhage
E. Callosal splenium lesion

B20.4

A 41-year-old woman has headache followed by confusion, and MRI shows bilateral thalamic edema with no history of alcohol use. A resident suggests Wernicke encephalopathy. Which finding favors deep cerebral venous thrombosis instead?

A. Enhancement of the mammillary bodies
B. Periaqueductal gray matter signal change
C. Signal in the floor of the fourth ventricle
D. Symmetric tectal plate hyperintensity
E. Spared mammillary bodies, occluded vein

B20.5

A 52-year-old man has quadriparesis after rapid correction of hyponatremia. MRI shows a central pontine lesion. Which structures are characteristically spared, producing a trident or bat-wing shape on axial images?

A. The entire pons, including the tegmentum
B. Middle cerebellar peduncles on both sides
C. Ventrolateral pons and corticospinal tracts
D. Medial lemnisci and central tegmental tracts
E. The basilar artery and its perforating branches

B20.6

A 57-year-old woman is comatose 2 days after cardiac arrest. Diffusion-weighted MRI is reviewed for hypoxic-ischemic injury. In which structures does diffusion restriction usually appear first within the first day?

A. Occipital cortex alone on both sides first
B. Subcortical U fibers
C. Corpus callosum alone
D. Basal ganglia, thalami, and cerebellum
E. Pons and medulla only

B20.7

A 36-year-old man is found confused after drinking large amounts of homemade spirits, with metabolic acidosis and visual loss. CT shows bilateral putaminal hypodensity with hemorrhage. Which toxin best explains these findings?

A. Carbon monoxide
B. Methanol
C. Cyanide
D. Ethylene glycol only
E. Lead

B20.8

A 28-year-old man who inhaled heated heroin vapor has ataxia. MRI shows symmetric white matter T2 hyperintensity in the posterior cerebrum and cerebellum. Which feature is typical of this toxic leukoencephalopathy?

A. Diffuse cortical diffusion restriction
B. Hemorrhagic putaminal necrosis
C. Sparing of the subcortical U fibers
D. Involvement of the pulvinar
E. Medial temporal lobe swelling

B20.9

A 19-year-old man has tremor, dysarthria, and abnormal liver tests. MRI shows signal change in the putamina and thalami and a face of the giant panda sign in the midbrain. Which diagnosis fits?

A. Wilson disease
B. Leigh syndrome
C. Creutzfeldt-Jakob disease
D. Hepatic encephalopathy
E. Carbon monoxide poisoning

B20.10

A 67-year-old woman has rapidly progressive dementia and myoclonus that developed over 3 months. Diffusion-weighted MRI shows restriction in the caudate, putamen, and cortical ribbon. Which diagnosis does this pattern suggest?

A. Wilson disease
B. Hepatic encephalopathy
C. Alzheimer disease with rapid course
D. Osmotic demyelination
E. Creutzfeldt-Jakob disease

PART VI · CHAPTER 21

Hydrocephalus and CSF Pressure Disorders

B21.1

A 45-year-old man with a posterior fossa tumor has headache and vomiting. MRI shows enlarged ventricles with smooth FLAIR hyperintensity capping the frontal and occipital horns. What does this periventricular signal represent?

A. Transependymal flow of cerebrospinal fluid
B. Chronic small vessel ischemic white matter disease
C. Periventricular demyelinating plaques
D. Normal ependymitis granularis variant
E. Tumor spread along the ependyma

B21.2

A 74-year-old woman has gait difficulty, and CT shows enlarged ventricles. The resident measures the maximal width of the frontal horns divided by the maximal inner skull width. Above which value does this ratio indicate enlargement?

A. 0.1
B. 0.3
C. 0.2
D. 0.5
E. 0.7

B21.3

A 16-year-old boy with a ventriculoperitoneal shunt has headache and vomiting, but CT shows small slit-like ventricles unchanged from 1 year ago. The clinician asks whether shunt failure is excluded. Which statement is correct?

A. Small ventricles exclude shunt malfunction
B. Only ventricular enlargement indicates failure
C. Raised pressure may occur without enlargement
D. A shunt series is never helpful in this case
E. Comparison with prior studies is not needed

B21.4

A 39-year-old woman has upgaze palsy and enlarged ventricles. MRI shows downward herniation of the third ventricle into the sella, a dilated suprapineal recess compressing the tectum, and a thin corpus callosum. What do these findings indicate?

A. Acute hydrocephalus within hours
B. Normal pressure hydrocephalus
C. Brain atrophy without hydrocephalus
D. Long-standing raised pressure
E. Intracranial hypotension

B21.5

A 77-year-old man with suspected idiopathic normal pressure hydrocephalus undergoes a cerebrospinal fluid tap test without improvement. The family asks whether shunting is still worth considering. Which statement is accurate?

A. A negative tap test excludes the diagnosis
B. The tap test is nearly 100% sensitive
C. Imaging alone always settles the decision
D. Shunting never helps tap test nonresponders
E. Patients may improve despite a negative tap

B21.6

A 70-year-old woman has gait disturbance and urinary urgency with ventriculomegaly but no DESH pattern on MRI. The neurologist asks whether the absence of DESH excludes idiopathic normal pressure hydrocephalus. Which response is correct?

A. Yes, DESH is present in all cases
B. Yes, DESH absence excludes shunting
C. No, DESH occurs only in children
D. No, DESH is a CT-only finding
E. No, DESH was present in only 64%

B21.7

A 27-year-old woman with idiopathic intracranial hypertension has stenosis of both transverse sinuses on venography. The neuro-ophthalmologist asks why this finding deserves specific comment in the report. Which reason is best?

A. It identifies stenting candidates
B. It proves the cause of the disease
C. It excludes the diagnosis
D. It indicates venous sinus thrombosis
E. It requires urgent thrombolysis

B21.8

A 42-year-old man has orthostatic headache for 3 weeks that began after lifting a heavy object at work, and the headache resolves when he lies flat. According to a UK multidisciplinary consensus guideline, what first-line imaging should be obtained?

A. CT of the head without contrast only
B. Lumbar puncture opening pressure first
C. Digital subtraction myelography as the first test
D. MRI of brain with contrast and whole spine
E. Radionuclide cisternography first

B21.9

A 51-year-old woman with orthostatic headache has cerebellar tonsillar descent on MRI, and a neurosurgeon considers Chiari decompression. The pons is flattened against the clivus. What is the most important consideration?

A. Chiari I malformation needing urgent surgery
B. Idiopathic intracranial hypertension
C. Intracranial hypotension mimicking Chiari
D. Normal pressure hydrocephalus
E. Posterior fossa tumor

B21.10

A 58-year-old woman with spontaneous intracranial hypotension has no spinal epidural collection. Decubitus CT myelography shows opacification of a paraspinal vein next to a thoracic nerve root sleeve. What does this sign indicate?

A. A ventral dural tear with a leak
B. A cerebrospinal fluid-venous fistula
C. A normal epidural venous plexus
D. Contrast within a ruptured perineural cyst
E. Postoperative pseudomeningocele

PART VI · CHAPTER 22

Epilepsy Imaging

B22.1

A 36-year-old man has a first unprovoked seizure, and his neurologist discusses the chance of recurrence. In adults, during which period is the risk of recurrence greatest, and what is its approximate range?

A. First week, over 90% in all
B. After 10 years, under 5% overall
C. First month, about 2% only
D. First 2 years, 21% to 45%
E. Lifetime risk, uniformly 100%

B22.2

A 72-year-old woman has a first seizure 3 days after an ischemic stroke. The resident asks how imaging goals differ for such seizures compared with unprovoked epilepsy. Which statement is correct?

A. Dedicated epilepsy protocol is required first
B. Imaging targets the acute provoking cause
C. Hippocampal volumetry is the first priority
D. Imaging is never needed after a stroke
E. Interictal PET should be performed first

B22.3

A hospital is revising its outpatient epilepsy MRI protocol. According to a published protocol proposal, what is the maximum slice thickness for T2-weighted and FLAIR images, and what T1 voxel size is recommended?

A. 10 mm; 5 mm two-dimensional T1
B. 6 mm; 3 mm 2D T1 slices
C. 3 mm; 1 mm isotropic 3D T1
D. 5 mm; 2 mm anisotropic T1
E. 8 mm; any T1 sequence

B22.4

A 30-year-old man with drug-resistant temporal lobe epilepsy undergoes anterior temporal resection, and has a resected hippocampus classified as ILAE type 1 hippocampal sclerosis. Which regions show the main neuronal loss in this type?

A. CA1 only
B. CA4 only
C. CA2 and CA3
D. Dentate gyrus only
E. CA1 and CA4

B22.5

A 25-year-old woman with temporal lobe epilepsy has MRI showing a small left hippocampus with increased T2 signal. Which secondary sign on MRI supports hippocampal sclerosis on the same side?

A. Atrophy of the ipsilateral fornix
B. Enlarged contralateral mammillary body
C. Thickened ipsilateral cortex
D. Enhancing hippocampal mass
E. Restricted diffusion in the splenium

B22.6

A 33-year-old man has epilepsy MRI showing a round, vertically oriented left hippocampus with otherwise normal signal and size. The referring physician asks whether this is the cause of the seizures. Which interpretation is correct?

A. A common variant, incomplete inversion
B. Definite hippocampal sclerosis needing surgery
C. A low-grade glioma
D. Focal cortical dysplasia
E. A hippocampal infarct

B22.7

A 19-year-old woman with focal seizures since childhood has a temporal cortical lesion that is cystic with a mural nodule, calcification, and variable enhancement. Which long-term epilepsy-associated tumor is most likely?

A. Dysembryoplastic tumor
B. Ganglioglioma
C. Glioblastoma
D. Metastasis
E. Meningioma

B22.8

A 4-year-old boy has episodes of laughter without mirth and precocious puberty. MRI shows a nonenhancing mass attached to the tuber cinereum, isointense to gray matter on T1-weighted images. Which lesion is it?

A. Optic pathway glioma of the chiasm
B. Craniopharyngioma
C. Germinoma
D. Hypothalamic hamartoma
E. Rathke cleft cyst

B22.9

A 27-year-old man had a cluster of seizures and an antiseizure drug change. MRI shows a small ovoid area of restricted diffusion in the splenium of the corpus callosum. What is the most likely course?

A. Progresses to infarction
B. Requires biopsy
C. Indicates demyelination
D. Predicts lymphoma
E. Usually resolves

B22.10

A 41-year-old woman with drug-resistant focal epilepsy undergoes ictal SPECT with tracer injection during a seizure. What does ictal SPECT typically show at the seizure onset zone, and what improves localization?

A. Hypoperfusion; contrast enhancement maps
B. Hypometabolism; FLAIR imaging
C. Hyperperfusion; interictal subtraction
D. Restricted diffusion; tractography
E. Normal perfusion; repeat CT only

PART VII · CHAPTER 23

Orbit and Visual Pathway

B23.1

A 9-year-old boy has nausea, bradycardia, and restricted upgaze after being struck in the eye by a ball. CT shows a small orbital floor fracture with minimal displacement. Why must the report describe the inferior rectus carefully?

A. Floor fractures never need treatment in children
B. The finding indicates a retrobulbar hematoma
C. Inferior rectus injury is always permanent
D. Only the medial wall can trap muscle in children
E. Trapdoor entrapment needs early surgery

B23.2

A 47-year-old man has painful proptosis and decreasing vision after facial trauma. CT shows a retrobulbar collection stretching the optic nerve with a tented posterior globe. How should this finding be communicated?

A. As an incidental finding
B. As a routine follow-up item
C. As a chronic change
D. As a surgical emergency
E. As a normal variant

B23.3

A 6-year-old girl has eyelid swelling and redness. The pediatrician asks when contrast-enhanced CT of the orbits is indicated to look for orbital cellulitis rather than isolated preseptal infection. Which finding is an indication?

A. Eyelid erythema with normal eye movement
B. Painful or restricted eye movement
C. Mild eyelid swelling with normal vision
D. Conjunctival discharge without other signs
E. A small stye on the lower eyelid margin

B23.4

A 52-year-old woman with Graves disease has proptosis. CT shows enlarged extraocular muscle bellies with sparing of the tendinous insertions. Which muscles are most often involved in thyroid eye disease?

A. Inferior and medial recti
B. Lateral and superior recti
C. Superior oblique only
D. Levator palpebrae only
E. Inferior oblique only

B23.5

A 39-year-old woman has painful ophthalmoplegia that developed over 2 weeks. MRI shows enhancing soft tissue in the orbital apex extending into the cavernous sinus, responsive to corticosteroids. Which syndrome describes this pattern?

A. Thyroid eye disease
B. Optic neuritis
C. Tolosa-Hunt syndrome
D. Carotid-cavernous fistula
E. Orbital lymphoma

B23.6

A 34-year-old woman with acute optic neuritis asks about corticosteroid treatment options. Which finding of the Optic Neuritis Treatment Trial concerns the use of oral prednisone alone at standard doses?

A. It produced the best visual outcome of all
B. It prevented multiple sclerosis entirely
C. It was equal to intravenous treatment
D. It shortened recovery more than any arm
E. It increased new optic neuritis episodes

B23.7

A 74-year-old woman has sudden painless visual loss with jaw claudication and a raised inflammatory marker. Orbital MRI is performed urgently. Which finding may be seen in giant cell arteritis?

A. Long optic nerve enhancement to the optic chiasm
B. Optic nerve sheath and orbital fat enhancement
C. Calcified mass in the globe
D. Tram-track tumor along the nerve
E. Fusiform enlargement of the nerve

B23.8

A 7-year-old child with neurofibromatosis type 1 has visual decline. MRI shows fusiform enlargement of the optic nerve that cannot be separated from the lesion. Which tumor is most likely?

A. Optic nerve sheath meningioma
B. Orbital lymphoma
C. Optic pathway glioma
D. Cavernous venous malformation
E. Schwannoma of the orbit

B23.9

A 61-year-old man has blurred vision and an intraocular mass that is hyperintense on T1-weighted and hypointense on T2-weighted MRI. Which tumor is most likely, and what explains this signal pattern?

A. Choroidal melanoma; melanin
B. Retinoblastoma; calcification
C. Choroidal hemangioma; blood
D. Metastasis; hemorrhage only
E. Lymphoma; high cellularity

B23.10

A 2-year-old child has leukocoria, and ultrasound shows a calcified intraocular mass. The ophthalmologist asks which imaging is preferred to evaluate optic nerve and intracranial spread of retinoblastoma. Which choice is best?

A. CT of the orbits and brain
B. Plain radiographs of the skull
C. PET-CT of the whole body
D. MRI, avoiding CT radiation
E. Orbital CT with contrast only

PART VII · CHAPTER 24

Temporal Bone and Cerebellopontine Angle

B24.1

A 5-year-old child who had bacterial meningitis is being evaluated for cochlear implantation. Temporal bone CT shows normal cochlear anatomy. Why is MRI also required before surgery in this child?

A. To measure the mastoid air cells
B. To confirm fluid-filled cochlea and nerve
C. To exclude a middle ear cholesteatoma first
D. To grade the ossicular chain
E. To assess the jugular bulb

B24.2

A 33-year-old man has conductive hearing loss and a retraction pocket in the pars flaccida. CT shows a soft tissue mass in Prussak space. Which structures does an acquired pars flaccida cholesteatoma typically erode?

A. Sinus tympani and facial recess
B. Round window and cochlear promontory
C. Stapes footplate and oval window
D. Jugular bulb and carotid canal
E. Scutum, malleus head, incus body

B24.3

A 45-year-old woman with cholesteatoma is scheduled for surgery. CT is reviewed for complications. Which complication is the most common and must be reported because it threatens hearing during surgery?

A. Sigmoid sinus thrombosis from spread
B. Tegmen dehiscence
C. Lateral semicircular canal fistula
D. Facial canal erosion
E. Carotid canal erosion

B24.4

A 48-year-old man with chronic ear discharge has a middle ear lesion with restricted diffusion on MRI. The lesion is also hyperintense on T1-weighted images. Which lesion should be considered instead of cholesteatoma?

A. Cholesterol granuloma
B. Pars flaccida cholesteatoma
C. Facial nerve schwannoma
D. Glomus tympanicum
E. Normal middle ear fluid

B24.5

A 78-year-old man with diabetes has severe ear pain and otorrhea, then develops a facial palsy. CT shows soft tissue in the external auditory canal and skull base erosion. Which diagnosis is most likely?

A. Acute otitis media with effusion
B. Cholesteatoma
C. Glomus jugulare
D. Necrotizing otitis externa
E. Bell palsy only

B24.6

A 27-year-old man has conductive hearing loss after a motorcycle crash with a longitudinal temporal bone fracture. CT is reviewed for ossicular injury. Which form of ossicular disruption is most common?

A. Incudostapedial separation
B. Fracture of the malleus head and neck
C. Stapes footplate fracture
D. Malleoincudal fusion
E. Fracture of the manubrium

B24.7

A 39-year-old woman has a cerebellopontine angle mass that is broad based along the dura, eccentric to the porus acusticus, and forms an obtuse angle with the petrous bone. Which diagnosis is favored?

A. Vestibular schwannoma
B. Meningioma
C. Epidermoid cyst
D. Arachnoid cyst
E. Lipoma

B24.8

A 52-year-old woman had a vestibular schwannoma resected 2 years ago. Serial contrast-enhanced MRI over 2 years shows linear enhancement in the operative bed that is unchanged. How should this be interpreted?

A. Definite recurrent schwannoma needing surgery
B. Meningitis needing urgent treatment
C. Common and stable postoperative change
D. Residual tumor needing radiosurgery
E. Leptomeningeal metastasis

B24.9

A 55-year-old woman has episodic vertigo, fluctuating low-frequency hearing loss, and aural fullness. Pure tone audiometry confirms the hearing loss. Which MRI technique can show endolymphatic hydrops supporting the clinical diagnosis?

A. Non-echoplanar diffusion-weighted imaging
B. Thin-section temporal bone CT
C. Time-of-flight angiography
D. Susceptibility-weighted imaging
E. Delayed postcontrast inner ear imaging

B24.10

A 46-year-old man has pulsatile tinnitus and a vascular retrotympanic mass on otoscopy. CT shows a soft tissue mass on the cochlear promontory with an intact jugular plate. Which lesion is most likely?

A. Aberrant internal carotid artery
B. Dehiscent high jugular bulb
C. Glomus jugulare paraganglioma
D. Glomus tympanicum paraganglioma
E. Cholesteatoma

PART VII · CHAPTER 25

Sinonasal Disease, Skull Base, and Cranial Nerves

B25.1

A 42-year-old woman with chronic rhinosinusitis has CT showing hyperdense contents expanding several sinuses with a serpiginous pattern. She has nasal polyps and asthma. Which diagnosis does this pattern suggest?

A. Allergic fungal sinusitis
B. Acute invasive fungal sinusitis
C. Fungus ball of the maxillary sinus
D. Sinonasal squamous cell carcinoma
E. Simple acute bacterial sinusitis

B25.2

A 64-year-old man has a single opacified maxillary sinus containing a hyperdense mass with punctate calcifications and no bone erosion. He is immunocompetent and otherwise well. Which diagnosis is most likely?

A. Angioinvasive mucormycosis
B. Allergic fungal rhinosinusitis
C. Antrochoanal polyp
D. Fungus ball
E. Odontogenic keratocyst

B25.3

A 15-year-old boy with frontal sinusitis has a soft forehead swelling and headache. CT shows frontal bone osteomyelitis with a subperiosteal abscess. Which additional imaging is preferred to assess intracranial spread?

A. Plain radiographs of the skull
B. MRI, more sensitive than CT
C. Repeat CT in 2 weeks only
D. Ultrasound of the forehead
E. Nuclear medicine bone scan

B25.4

A 51-year-old woman has foul-smelling unilateral maxillary sinus disease. CT shows periapical lucency around a maxillary molar root with dehiscence of the sinus floor. Which source should the report name?

A. Eosinophilic fungal disease
B. Inverted papilloma
C. Odontogenic sinusitis
D. Mucormycosis of the sinus
E. Silent sinus syndrome

B25.5

A 58-year-old man with neutropenia has nasal congestion and facial pain. CT shows only mild mucosal thickening but infiltration of the fat behind the maxillary sinus. What is the significance of this finding?

A. Normal finding in most neutropenic adults
B. A sign of chronic sinus disease
C. Evidence of a fungus ball
D. A postoperative change only
E. Early sign of invasive fungal sinusitis

B25.6

A 47-year-old man with anosmia and epistaxis has a nasal cavity mass with a dumbbell shape across the cribriform plate and cysts at its intracranial margin. Which tumor is most likely?

A. Inverted papilloma
B. Olfactory neuroblastoma
C. Adenoid cystic carcinoma
D. Juvenile angiofibroma
E. Chondrosarcoma

B25.7

A 44-year-old woman has a skull base mass off midline along the petro-occipital fissure, bright on T2-weighted images, with ring-and-arc calcifications on CT. Which tumor is most likely and why does the distinction matter?

A. Chordoma; better prognosis than chondroid
B. Meningioma; worse prognosis
C. Metastasis; better prognosis
D. Plasmacytoma; worse prognosis
E. Chondrosarcoma; better prognosis

B25.8

A 49-year-old woman with pulsatile tinnitus has a jugular foramen mass with permeative moth-eaten bone erosion on CT and a salt-and-pepper appearance with flow voids on MRI. Which lesion is it?

A. Schwannoma
B. Meningioma
C. Chondrosarcoma
D. Paraganglioma
E. Epidermoid

B25.9

A 50-year-old man has a facial palsy that has not recovered after 6 months, initially diagnosed as Bell palsy. Otherwise his examination is normal. Which reason prompts MRI in this setting?

A. Exclude tumor or perineural spread
B. Confirm a typical Bell palsy pattern
C. Measure the mastoid air cells
D. Grade the facial muscles
E. Assess middle ear effusion

B25.10

A 63-year-old man has left vocal cord paralysis on laryngoscopy and hoarseness. Head CT is normal. How far caudally must imaging extend on the left to evaluate the recurrent laryngeal nerve?

A. To the hyoid bone only
B. To the skull base only
C. To the aortopulmonary window
D. To the thyroid isthmus only
E. To the carotid bifurcation level

PART VII · CHAPTER 26

Neck Spaces, Lymph Nodes, Thyroid, and Head and Neck Cancer

B26.1

A 46-year-old woman has a slowly growing painless parotid mass noticed over 2 years that is well defined, lobulated, and very bright on T2-weighted images, without restricted diffusion. Which tumor is most likely?

A. Pleomorphic adenoma
B. Warthin tumor in a smoker
C. Mucoepidermoid carcinoma
D. Adenoid cystic carcinoma
E. Parotid lymphoma deposit

B26.2

A 69-year-old man with a long smoking history has slowly enlarging bilateral parotid masses. MRI shows well-defined lesions, and pertechnetate scintigraphy shows uptake in both lesions. Which diagnosis is most likely?

A. Pleomorphic adenoma
B. Mucoepidermoid carcinoma
C. Adenoid cystic carcinoma
D. Acinic cell carcinoma
E. Warthin tumor

B26.3

A 55-year-old woman has primary hyperparathyroidism and a negative sestamibi scan. Four-dimensional CT of the neck is performed before planned minimally invasive surgery. Which enhancement pattern is typical of a parathyroid adenoma?

A. Delayed progressive enhancement only on late phase
B. Early arterial enhancement with washout
C. No enhancement on any phase
D. Peripheral rim enhancement alone
E. Enhancement identical to the thyroid

B26.4

A 62-year-old man with laryngeal cancer has a level II node measuring 10.5 mm in minimal axial diameter without necrosis. Which size threshold for the subdigastric region was most effective in a study of 2719 nodes?

A. 5 mm maximal axial diameter
B. 15 mm longitudinal length on sagittal
C. 20 mm maximal diameter
D. 11 mm minimal axial diameter
E. 8 mm longitudinal length

B26.5

A 57-year-old man with tongue cancer has a level II node with irregular margins, infiltration of the surrounding fat, and invasion of the sternocleidomastoid muscle. What does this appearance indicate?

A. Reactive hyperplasia
B. A normal fatty hilum
C. Extranodal extension
D. Branchial cleft cyst
E. Tuberculous adenitis

B26.6

A 28-year-old woman from an endemic region has matted, necrotic cervical nodes with surrounding inflammation and calcification. She has low-grade fever, night sweats, and weight loss. Which diagnosis is favored?

A. Reactive lymphoid hyperplasia
B. Hodgkin lymphoma
C. Kikuchi disease
D. Tuberculous lymphadenitis
E. Branchial cleft cyst

B26.7

A 59-year-old man with stage III oropharyngeal squamous cell carcinoma asks his oncologist how tumor HPV status affects survival. What did a trial report for 3-year overall survival by HPV status?

A. 57.1% positive vs 82.4% negative
B. 82.4% positive vs 57.1% negative
C. No difference by HPV status
D. 95% in both groups
E. 40% positive vs 70% negative

B26.8

A 64-year-old man has squamous cell carcinoma in a neck node with no obvious primary on initial examination. Where should the radiologist look first, because small primary tumors hide there?

A. Thyroid gland and the parathyroid glands
B. Parotid and submandibular glands
C. Oral tongue and floor of mouth
D. Larynx and cervical esophagus
E. Tonsils, base of tongue, nasopharynx

B26.9

A 60-year-old man completed chemoradiotherapy for oropharyngeal cancer 4 weeks ago. The referring oncologist requests FDG PET-CT now to assess treatment response. When is posttreatment PET-CT usually performed and why?

A. About 12 weeks, after inflammation subsides
B. Within 1 week, before inflammation develops
C. At 4 weeks, when uptake is most specific
D. After 2 years, when recurrence peaks
E. Only if a new mass becomes palpable

B26.10

A neck CT obtained for a 29-year-old woman after a minor motor vehicle collision shows an incidental 1.2 cm thyroid nodule. The cervical nodes are normal and there is no invasion. What does the ACR approach recommend?

A. No further evaluation
B. Immediate thyroidectomy
C. Thyroid ultrasound
D. Radioiodine scan
E. Repeat CT in 5 years

PART VIII · CHAPTER 27

Degenerative Spine Disease

B27.1

A 45-year-old man has sciatica, and MRI shows a fragment of disc material in the epidural space behind the L5 vertebral body that has no continuity with the parent disc. Which term best describes the fragment?

A. Sequestration
B. Protrusion
C. Bulge
D. Annular fissure
E. Schmorl node

B27.2

A 51-year-old woman has recurrent right leg pain 1 year after L5-S1 discectomy. Contrast-enhanced MRI shows epidural tissue that enhances only at its periphery. What is the most likely diagnosis?

A. Epidural scar tissue alone
B. Recurrent disc herniation
C. Postoperative seroma
D. Epidural abscess
E. Arachnoiditis

B27.3

A 58-year-old man has a calcified thoracic disc herniation compressing the cord on MRI. The surgeon plans surgery and asks for CT. Besides showing calcification, which reporting step prevents a recognized surgical error?

A. Measuring disc height only
B. Grading Modic changes
C. Assessing facet effusions
D. Careful level counting
E. Reporting disc bulges

B27.4

A 60-year-old woman with chronic low back pain has endplate marrow signal that is high on T1-weighted images at a degenerated L4-L5 disc. What does this Modic type 2 change reflect histologically?

A. Vascularized fibrous tissue
B. Sclerotic bone
C. Yellow marrow replacement
D. Active infection
E. Metastatic disease

B27.5

A 56-year-old man with back pain has marrow edema on both sides of the L3-L4 disc. The disc does not show fluid signal, and the endplate outlines are preserved without paraspinal inflammation. Which interpretation is favored?

A. Pyogenic discitis-osteomyelitis
B. Tuberculous spondylitis
C. Metastatic disease at both endplates
D. Acute osteoporotic fracture
E. Degenerative Modic type 1 change

B27.6

A 19-year-old athlete has low back pain worse with extension, and CT shows a defect of the pars interarticularis with anterolisthesis. At which level is this type of spondylolisthesis most often found?

A. L1-L2
B. L5-S1
C. L2-L3
D. L3-L4
E. T12-L1

B27.7

A 66-year-old man with progressive cervical myelopathy has axial T2-weighted images showing bilateral symmetric hyperintensity in the anterior horns of the cord at C5-C6. What does this snake-eyes pattern reflect?

A. Acute demyelinating plaques in both horns
B. Normal anterior horn signal in older adults
C. Spinal cord infarction from aortic disease
D. Gray matter injury from chronic compression
E. Syrinx formation from Chiari malformation

B27.8

A 62-year-old man with cervical myelopathy has a linear hyperdense band behind the C3 to C5 vertebral bodies on radiographs. Which imaging best shows the extent and thickness of ossification of the posterior longitudinal ligament?

A. Ultrasound
B. Plain MRI only
C. Myelography
D. Bone scan
E. CT

B27.9

A 47-year-old woman has neck pain and paresthesia radiating to the thumb with weak wrist extension consistent with a C6 radiculopathy. At which disc level does the C6 nerve root exit?

A. C6-C7
B. C4-C5
C. C5-C6
D. C7-T1
E. C3-C4

B27.10

A 40-year-old woman with mild back pain asks whether disc degeneration on her MRI is unusual for her age. In a systematic review of 3110 asymptomatic individuals, how did disc degeneration prevalence change with age?

A. 37% at 20 to 96% at 80
B. 5% at 20 to 20% at 80
C. Unchanged at 50% throughout
D. 90% at 20 to 30% at 80
E. 1% at 20 to 10% at 80

PART VIII · CHAPTER 28

Spinal Cord Disease

B28.1

A 50-year-old man has a myelopathy that progressed slowly over 8 months, and MRI shows a cord signal abnormality. The resident asks how the tempo of onset narrows the differential. Which group fits onset over months?

A. Infarction from aortic disease alone in all cases
B. Acute viral myelitis only
C. Demyelination within hours
D. Trauma within minutes
E. Compression, malformation, tumor, deficiency

B28.2

A 5-year-old child has acute asymmetric limb weakness after a respiratory illness. Spinal MRI shows T2 hyperintensity confined to the anterior horns of the gray matter. Which diagnosis is most likely?

A. Acute flaccid myelitis
B. HIV vacuolar myelopathy
C. Schistosomal myelitis
D. Multiple sclerosis
E. Radiation myelopathy

B28.3

A 23-year-old man who swam in fresh water in sub-Saharan Africa has subacute leg weakness and urinary retention. MRI shows an expanded conus with nodular enhancement. Which infection is most likely?

A. Vacuolar HIV myelopathy
B. Herpes zoster
C. Enterovirus
D. Schistosomiasis
E. Tuberculosis

B28.4

A 64-year-old woman has a subacute progressive myelopathy with symmetric, tract-specific T2 hyperintensity of the lateral columns on MRI. Infectious and demyelinating tests are negative. Which further search should follow?

A. No further investigation is needed
B. A search for an underlying cancer
C. Repeat MRI in 5 years only
D. Spinal angiography only
E. Biopsy of the spinal cord

B28.5

A 36-year-old woman has stepwise myelopathy. MRI shows a mulberry intramedullary lesion with mixed signal and a complete hemosiderin rim dark on gradient-echo images, without a feeding artery. Which lesion is it?

A. Spinal dural arteriovenous fistula
B. Hemangioblastoma
C. Cavernous malformation
D. Ependymoma
E. Cord metastasis

B28.6

A 9-year-old child with neck pain and arm weakness has an intramedullary cervical tumor that is eccentric, ill defined, and patchily enhancing. Which tumor is most likely in this age group?

A. Ependymoma
B. Hemangioblastoma
C. Meningioma
D. Astrocytoma
E. Schwannoma

B28.7

A 58-year-old man with lung cancer and new leg weakness has a small enhancing intramedullary nodule with extensive cord edema out of proportion to its size. Which diagnosis does this appearance suggest?

A. Cord ependymoma with a cleavage plane
B. Cavernous malformation
C. Intramedullary metastasis
D. Arachnoid web
E. Radiation myelopathy

B28.8

A 30-year-old man has an enhancing cord lesion, and both tumor and inflammatory myelitis are considered. The neurologist asks whether immediate biopsy is needed. Which approach is usually more useful?

A. Short-interval follow-up after treatment
B. Immediate open biopsy of the spinal cord
C. Repeat MRI only after 2 years
D. Radiotherapy without a diagnosis
E. No follow-up imaging at all

B28.9

A 49-year-old woman has progressive gait disturbance and a dorsal indentation of the thoracic cord on sagittal MRI with a sharp transition resembling a scalpel blade. Which diagnosis does this sign indicate?

A. Ventral cord herniation
B. Epidural lipomatosis
C. Spinal meningioma
D. Syringomyelia
E. Arachnoid web

B28.10

A 61-year-old man treated with radiation for lung cancer 18 months ago develops myelopathy. MRI shows cord T2 hyperintensity confined to one segment. Which adjacent finding marks the radiation field?

A. Collapse of the adjacent vertebral body
B. Fatty vertebral marrow replacement
C. Epidural abscess
D. Disc space fluid
E. Paraspinal mass

PART VIII · CHAPTER 29

Spine Trauma, Infection, and Vertebral Tumors

B29.1

A 37-year-old woman has neck pain after a motor vehicle collision. Cervical spine CT shows a fracture extending through the right C4 transverse foramen. Which additional imaging should be added?

A. Flexion and extension radiographs
B. Repeat CT in 2 weeks only
C. CT angiography of the neck
D. Ultrasound of the thyroid gland
E. Bone scintigraphy of the neck

B29.2

A 28-year-old woman wearing a lap belt in a car crash has abdominal bruising. CT shows a horizontal fracture through the L1 vertebral body and posterior elements. Which associated injury should the report prompt a search for?

A. Aortic dissection
B. Renal infarction
C. Splenic laceration only
D. Pancreatic tumor
E. Bowel injury

B29.3

A 72-year-old man with ankylosing spondylitis falls from standing height and has neck pain. Radiographs show only a subtle lucency through a fused cervical segment. How should fractures in an ankylosed spine be regarded?

A. Usually stable and treated with rest alone
B. Highly unstable, like long-bone fractures
C. Rarely clinically significant in falls
D. Always obvious on plain radiographs
E. Stable unless the patient is young

B29.4

A 79-year-old woman falls and has neck pain. CT shows a fracture through the base of the dens. The surgeon asks which odontoid fracture type is most prone to nonunion. Which type is it?

A. Type II
B. Type I
C. Type III
D. Type IV
E. Type 0

B29.5

A 31-year-old man has a C1 ring fracture after a diving accident. CT shows lateral mass overhang relative to C2 and a widened atlantodental interval. Which injury do these findings indicate?

A. Isolated spinous process fracture
B. Atlanto-occipital fusion
C. Stable posterior arch fracture
D. Transverse ligament injury
E. Odontoid type I fracture

B29.6

A 55-year-old man has fever, rigors, and back pain. MRI shows destruction of the L2-L3 disc with small, thick-walled paraspinal collections. Which organism type does this pattern favor over tuberculosis?

A. Tuberculous spondylitis of the spine
B. Brucellosis
C. Pyogenic bacterial infection
D. Fungal infection
E. Hydatid disease

B29.7

A 45-year-old man imaged for low back pain after lifting has an incidental vertebral lesion with coarse vertical trabeculae on CT and high T1 signal on MRI. Which lesion is it?

A. Lytic myeloma deposit
B. Aggressive hemangioma
C. Osteoblastic prostate metastasis
D. Typical vertebral hemangioma
E. Vertebral lymphoma deposit

B29.8

A 66-year-old woman has multiple lytic spinal lesions and anemia, and myeloma is diagnosed. Which imaging approach is used to stage the disease rather than a conventional radiographic skeletal survey?

A. Whole-body low-dose CT or MRI
B. Plain chest radiograph alone
C. Lumbar spine radiographs only
D. Bone scintigraphy alone
E. Ultrasound of the abdomen

B29.9

A 58-year-old man with prostate cancer has epidural tumor that deforms the thecal sac without contacting the cord. Under the epidural spinal cord compression scale, how is low-grade compression often treated?

A. Immediate surgery
B. Observation only
C. Chemotherapy only
D. Vertebroplasty only
E. Radiation alone

B29.10

A 62-year-old man with known lymphoma has new leg weakness. MRI shows an epidural soft tissue mass encasing the thoracic cord with normal adjacent vertebral bodies. Which diagnosis best explains this pattern?

A. Osteoporotic fracture
B. Epidural lymphoma
C. Vertebral hemangioma
D. Discitis-osteomyelitis
E. Radiation myelopathy

PART IX · CHAPTER 30

Congenital Malformations and Pediatric Neuroradiology

B30.1

A 3-year-old child with seizures and hemiparesis has brain MRI showing a cleft lined by gray matter extending from the lateral ventricle to the cortical surface. Which malformation is this?

A. Porencephaly
B. Polymicrogyria
C. Lissencephaly
D. Heterotopia
E. Schizencephaly

B30.2

An infant with severe early epilepsy has an enlarged left hemisphere with dysplastic cortex, abnormal white matter, and an enlarged left lateral ventricle. Which diagnosis is it, and what treatment may be needed?

A. Hemimegalencephaly; hemispherectomy
B. Sturge-Weber syndrome; laser therapy
C. Rasmussen encephalitis; steroids only
D. Lissencephaly; ventricular shunt
E. Schizencephaly; cleft closure

B30.3

A newborn has a posterior fossa cyst on MRI. The vermis is normal in size but displaced by a cyst communicating with the fourth ventricle, and the tentorium is not elevated. Which diagnosis is most likely?

A. Dandy-Walker malformation
B. Blake pouch cyst
C. Mega cisterna magna
D. Arachnoid cyst
E. Chiari II malformation

B30.4

A 6-year-old boy with a facial port-wine birthmark has seizures. CT shows gyriform cortical calcification in a tram-track pattern with atrophy of the underlying occipital lobe. Which syndrome is it?

A. Tuberous sclerosis complex
B. Neurofibromatosis type 1
C. Von Hippel-Lindau disease
D. Sturge-Weber syndrome
E. NF2-related schwannomatosis

B30.5

A 10-year-old girl with neurofibromatosis type 1 has a lobulated mass infiltrating along the nerves of the neck. On T2-weighted images it shows central low signal with a bright rim. Which lesion is this?

A. Optic pathway glioma
B. Malignant schwannoma
C. Plexiform neurofibroma
D. Lymphatic malformation
E. Infantile hemangioma

B30.6

A 2-year-old with seizures has MRI showing multiple cortical tubers and radial migration lines. Updated tuberous sclerosis complex criteria changed how these findings are named. Which term replaced cortical dysplasias?

A. Subcortical band heterotopia
B. Periventricular nodular heterotopia along the walls
C. Focal areas of signal intensity
D. Polymicrogyria of the Sylvian fissure
E. Multiple cortical tubers or radial migration lines

B30.7

A term neonate with encephalopathy completed therapeutic hypothermia. The neonatologist asks when MRI is commonly obtained, given how diffusion changes evolve over the first week. Which timing is commonly used?

A. Between days 4 and 7
B. Within the first 6 hours
C. At exactly 24 hours of life
D. After 6 weeks of age
E. Only at 1 year of age

B30.8

A term neonate after a difficult delivery has MRI on day 5. The normal T1 hyperintensity of the posterior limb of the internal capsule is absent. What does this finding indicate?

A. Normal finding at term
B. Delayed myelination only
C. Important sign of injury
D. Artifact from motion
E. Sign of a metabolic disease

B30.9

A healthy newborn has a simple skin dimple located low in the gluteal crease without other cutaneous markers. The pediatrician asks whether spinal imaging is needed. Which statement is correct?

A. MRI is needed urgently
B. CT is the first test
C. It indicates a dermal sinus
D. It carries little risk
E. It requires surgery

B30.10

A 4-year-old girl has progressive leg weakness, foot deformity, and scoliosis. MRI shows the cord divided into two hemicords with a bony septum between them. How is this malformation classified?

A. Type II split cord malformation
B. Type I split cord malformation
C. Caudal regression syndrome
D. Intradural lipoma only
E. Tight filum terminale only

ANSWERS

Answers and Explanations

Chapter 1: Imaging Techniques, Contrast, and Safety

B1.1 Answer A
A brain window near 40/80 Hounsfield units shows parenchyma well but makes a thin subdural collection against the bright inner table easy to miss. A wider subdural window separates blood from bone, and a bone window shows fractures. All three are reviewed on every head CT, especially after trauma in an anticoagulated patient. Contrast and thicker sections do not replace these windows and can hide small findings.
Principle: Every head CT needs brain, subdural, and bone windows.

B1.2 Answer E
In a four-institution study, the median effective dose for a routine head CT was 2 millisieverts, but there was a mean 13-fold variation within each study type. Such variation reflects differences in protocols and institutions rather than patient size alone, and it supports protocol review and dose monitoring. Identical doses or variation under 10% were not observed, and the variation was not confined to children.
Principle: Head CT dose varies widely between protocols and institutions.

B1.3 Answer D
Dual-energy CT acquires the same anatomy at two x-ray spectra, and the difference separates materials that look alike at a single energy. Iodine and calcium, both hyperdense on conventional images, can be split into separate maps, and the same principle separates iodine staining of injured tissue from blood after thrombectomy. An iodine map that explains the density supports staining, while persistent density on the virtual noncontrast image suggests hemorrhage. The other options cannot make this distinction.
Principle: Dual-energy CT separates iodine staining from hemorrhage.

B1.4 Answer C
Susceptibility-weighted imaging combines a phase mask with the magnitude image, which increases sensitivity to blood products, mineral, and veins. Blooming, the spread of signal loss beyond the actual deposit, makes blood products look larger than they are. The report therefore counts and locates microbleeds rather than measuring them as precise sizes. Phase information can help separate calcium from blood, so the foci are not assumed to be calcium.
Principle: Blooming on susceptibility imaging exaggerates the size of blood products.

B1.5 Answer B
Consensus statements from radiology and nephrology societies reframed the kidney risk of intravenous iodinated contrast. Saline prophylaxis is indicated for patients with acute kidney injury or an eGFR below 30 mL/min/1.73 m2 who are not on dialysis. An eGFR of 24 meets that threshold, so prophylaxis is reasonable while the indicated study proceeds. Contrast is not contraindicated below 60, and dialysis is not scheduled because of contrast.
Principle: Give saline prophylaxis for AKI or eGFR below 30 when not on dialysis.

B1.6 Answer A
Group II gadolinium agents are macrocyclic or otherwise stable agents with a very low risk of nephrogenic systemic fibrosis. In a pooled analysis, no nephrogenic systemic fibrosis followed 4931 group II administrations at an eGFR below 30. When contrast is needed for diagnosis, a group II agent can be given rather than withholding an important study. Group I agents carry the historical risk, and the eGFR is not an absolute contraindication.
Principle: Group II gadolinium agents carry minimal NSF risk even at low eGFR.

B1.7 Answer E
Dentate nucleus T1 hyperintensity tracks the number of prior gadolinium doses and reflects retained gadolinium. Tissue gadolinium is dose-dependent even with normal renal function, so retention occurs without kidney disease. Manganese deposition in liver disease affects the globus pallidus, hemorrhage would show susceptibility, and calcification has a different CT appearance. The report can note the finding without implying harm, while contrast use is kept to clear indications.
Principle: Dentate T1 hyperintensity after many contrast MRIs reflects gadolinium retention.

B1.8 Answer C
MRI safety uses four zones. Zone I is the general public area, Zone II is reception and screening, Zone III is restricted to screened people under the supervision of MR personnel, and Zone IV is the magnet room itself. Many projectile accidents involve ordinary objects such as oxygen cylinders carried past these boundaries. The magnet of a superconducting scanner is always on, so the field is present even when no scan is running.
Principle: Zone IV is the magnet room; nothing unscreened enters it.

B1.9 Answer B
A 3 T magnet doubles the signal available at 1.5 T and improves small lesion detection and spectroscopy. It also doubles chemical shift, increases susceptibility artifact near metal and air, and deposits more radiofrequency energy, so specific absorption rate limits are reached sooner. Motion ghosting along the phase-encoding direction is unaffected by field strength. Protocols are adjusted to these tradeoffs rather than assuming that the higher field is better in every respect.
Principle: 3 T doubles signal but increases susceptibility and chemical shift artifacts.

B1.10 Answer D
In experimental ischemia in cat brain, diffusion-weighted hyperintensity appeared at 45 minutes, hours before any change on T2-weighted images. Cytotoxic edema restricts water motion before the total tissue water content rises enough to change T2 signal. This early sensitivity is why diffusion imaging is central to acute stroke evaluation, and why a normal T2 image early after onset does not exclude infarction.
Principle: Diffusion shows ischemia within minutes, before T2 changes.

Chapter 2: Neuroanatomy, Normal Variants, and the Search Pattern

B2.1 Answer A
The central sulcus is found with two landmarks on axial images: the hand knob of the precentral gyrus and the right-angle junction of the superior frontal sulcus with the precentral sulcus. The gyrus immediately behind the precentral sulcus is the precentral gyrus, and the central sulcus lies behind it. The other junctions locate the occipital lobe, the cingulate region, the insula, or the deep gray matter rather than the motor cortex.
Principle: The superior frontal sulcus meets the precentral sulcus at a right angle.

B2.2 Answer B
Ventricles enlarged out of proportion to the sulci suggest hydrocephalus, whereas volume loss enlarges sulci and ventricles in proportion. Recognizing the disproportion directs further assessment, such as evaluation for normal pressure hydrocephalus or obstruction. Diffuse edema effaces both ventricles and sulci, and infarcts produce territorial low density rather than isolated ventricular enlargement. Comparison with earlier imaging shows whether the disproportion is new.
Principle: Ventricles out of proportion to sulci suggest hydrocephalus.

B2.3 Answer D
An entirely complete circle of Willis was present in 42% of volunteers on time-of-flight MR angiography, so variants are the norm rather than the exception. Hypoplastic or absent communicating segments and fetal posterior cerebral arteries are common. Knowing the variants explains unexpected infarct patterns and alters collateral capacity in carotid disease, and they should not be reported as abnormalities. Reports describe them as variants.
Principle: A complete circle of Willis is present in a minority of adults.

B2.4 Answer C
The internal watershed lies in the deep white matter between the lenticulostriate and medullary artery territories. Infarcts in a chain along the internal watershed point toward hypoperfusion distal to a stenosis rather than embolism, which more often produces scattered cortical and territorial lesions. A single lacune reflects disease of one perforator, venous infarcts follow venous drainage, and vasculitis produces multifocal lesions of different ages. The report names the pattern because it supports evaluation of the stenosis.
Principle: A chain of deep watershed infarcts suggests hemodynamic compromise.

B2.5 Answer E
Perivascular spaces follow cerebrospinal fluid on every sequence and cluster in the basal ganglia, the high convexities, and the midbrain. Lacunar infarcts usually have a FLAIR-hyperintense rim, plaques are bright on FLAIR, metastases enhance, and cysticercosis cysts may contain a scolex or enhance. Recognizing perivascular spaces avoids reporting a variant as disease, although many enlarged spaces can accompany small vessel disease.
Principle: Perivascular spaces follow CSF signal on every sequence.

B2.6 Answer B
In the Rotterdam Study of the general population, incidental asymptomatic infarcts were found in 7.2%, aneurysms in 1.8%, and benign tumors in 1.6%. These frequencies show that incidental findings are common and that the report must decide which of them matter. Silent infarcts in particular are more common than aneurysms or tumors in older adults, and they inform vascular risk assessment.
Principle: Silent infarcts are the most common incidental finding in older adults.

B2.7 Answer E
Pineal cysts of 5 mm or more were found in 1.0% of adults in a population study, and most stayed stable or shrank on follow-up. A typical cyst with fluid signal, a thin rim, and no solid component is reported as a common variant. Growth, nodular enhancement, or hydrocephalus would change management, but these are uncommon, so routine lifelong imaging is not needed.
Principle: Most adult pineal cysts remain stable or shrink.

B2.8 Answer D
A fixed search pattern ensures that every region is inspected. On head CT it runs through the brain window, the subdural window, and the bone window, and then the margins of the field of view, such as the orbits, sinuses, mastoids, skull base, and upper cervical spine. Ending at the margins catches incidental but important findings, and comparison with prior studies follows.
Principle: Review brain, subdural, and bone windows, then the margins.

B2.9 Answer A
The report answers the requisition's question in its opening lines, so the referring physician immediately learns that no cerebellopontine angle mass is present. Variants such as perivascular spaces and a small pineal cyst are described afterward and labeled as variants. Burying the answer below a list of incidental findings risks confusion and unnecessary follow-up. Brief, clear reporting also reduces calls back to the department.
Principle: Answer the clinical question first in the report.

B2.10 Answer C
Each cistern around the brainstem is named on review because effacement of a cistern is often the first sign of mass effect. The ambient cisterns wrap around the midbrain, and asymmetry of the ambient cisterns is an early sign of uncal herniation, in which the medial temporal lobe moves over the tentorial edge. In a drowsy patient with a temporal hematoma, the finding is reported urgently even before the midline shift increases.
Principle: Ambient cistern asymmetry is an early sign of uncal herniation.

Chapter 3: Acute Ischemic Stroke and Imaging for Reperfusion

B3.1 Answer E
Stroke mimics are excluded at the first imaging step. A tumor, subdural hematoma, or abscess may be visible on CT, but seizure, migraine with aura, and hypoglycemia leave the CT normal and are recognized clinically or on MRI. A normal CT therefore neither excludes early infarction nor proves a mimic, and CT angiography excludes a large vessel occlusion. The clinical picture of limb jerking raises seizure, and MRI with diffusion can help separate the two.
Principle: A normal CT does not exclude seizure, migraine, or hypoglycemia as mimics.

B3.2 Answer A
MRI can replace CT as the first study where it is immediately available. Diffusion-weighted imaging shows infarction within minutes, susceptibility-weighted or gradient-echo images detect hemorrhage, including microbleeds that CT cannot see, and FLAIR helps estimate lesion age. The cost is time and screening, because patients with contraindicated devices or instability cannot go straight to the scanner. Protocols are kept short to avoid delaying treatment.
Principle: MRI detects acute hemorrhage and microbleeds invisible on CT.

B3.3 Answer D
ASPECTS is scored region by region, with the symptomatic side known, at a narrow window on images aligned to the canthomeatal line. Only new hypoattenuation or swelling counts, so chronic infarcts and periventricular small vessel change do not reduce the score. Counting old damage would understate the salvageable brain and could wrongly exclude the patient from treatment. Automated software output is also checked against the images for the same reason.
Principle: ASPECTS counts only new hypoattenuation or swelling.

B3.4 Answer B
ASPECTS can be applied to diffusion-weighted images, where early infarction is more conspicuous than on CT. The two are not interchangeable: diffusion shows more of the ischemic tissue at the same time point, so a diffusion score tends to run lower than the CT score in the same patient. A lower diffusion score shortly after CT does not by itself indicate rapid growth, and the report names the modality used for the score.
Principle: Diffusion ASPECTS runs lower than CT ASPECTS at the same time point.

B3.5 Answer C
Tandem lesions and dissections change the procedure. A cervical internal carotid occlusion in front of an intracranial occlusion must be crossed or stented before the intracranial clot can be reached, and a flame-shaped tapering at the carotid origin suggests dissection rather than atherosclerosis. Calcified plaque at the bulb would favor atherosclerosis. Reporting the tandem lesion prepares the team for the additional step and device choice.
Principle: Flame-shaped carotid tapering suggests dissection in a tandem lesion.

B3.6 Answer E
Collaterals are graded by comparing the vessels beyond the occlusion with the same vessels on the healthy side. On single-phase CT angiography, a territory with abundant filling of pial branches carries a better prognosis than one with sparse or absent filling. Multiphase CT angiography adds later acquisitions and shows whether filling is merely delayed. Sparse collaterals predict faster core growth, which the report describes because it bears on outcome.
Principle: Better pial collateral filling predicts better prognosis.

B3.7 Answer D
Perfusion volumes are defined by thresholds. Many platforms define the hypoperfused region as tissue with a time to maximum of contrast longer than 6 seconds, and the core on CT perfusion as tissue with cerebral blood flow below 30% of the opposite hemisphere. On diffusion imaging, the core is the region of restricted diffusion. Knowing the thresholds helps the radiologist recognize when motion or bolus problems distort the maps.
Principle: Common CTP thresholds: Tmax over 6 s for hypoperfusion, rCBF under 30% for core.

B3.8 Answer A
Basilar artery occlusion can present with fluctuating coma, vertigo, or diplopia rather than hemiparesis, and the occluded basilar artery is easy to overlook on a quick review of CT angiography focused on the anterior circulation. Thrombectomy for basilar occlusion improved function and reduced mortality in recent trials, so missing it has serious consequences. The other vessels do not explain this syndrome.
Principle: Check the basilar artery in fluctuating coma, vertigo, and diplopia.

B3.9 Answer B
The EXTEND trial randomized patients with hypoperfused but salvageable tissue on automated perfusion imaging to alteplase or placebo between 4.5 and 9.0 hours after onset or on awakening with stroke, and excellent outcome was more frequent with alteplase at the cost of more symptomatic hemorrhage. DAWN addressed thrombectomy for large vessel occlusion, ATTENTION and BAOCHE basilar occlusion, and RESCUE-Japan LIMIT large cores.
Principle: EXTEND supports perfusion-selected thrombolysis up to 9 hours or on waking.

B3.10 Answer C
In the report, the occluded segment is named precisely because a distal M2 occlusion and an M1 occlusion carry different expectations for benefit and technique. The report also flags a dissection, a tandem lesion, or an anatomic obstacle to access, and describes collaterals and clot burden. A vague label leaves the interventional team without the information that determines whether and how thrombectomy proceeds.
Principle: Name the occluded segment precisely in a stroke report.

Chapter 4: Stroke Mechanisms, Small Vessel Disease, and Stroke Mimics

B4.1 Answer D
Diffusion imaging shows small cortical emboli that CT misses and separates acute lesions from old ones. A patient with a clinically lacunar syndrome may have several small cortical diffusion lesions, which move the mechanism from small vessel disease to embolism and change the workup toward cardiac and arterial sources. The imaging pattern, not the clinical syndrome alone, guides the classification, and the report states which pattern is present.
Principle: Multiple small cortical DWI lesions point to embolism even with a lacunar syndrome.

B4.2 Answer A
Cardiac sources are increasingly imaged by the same department. Cardiac CT acquired with a stroke CT angiogram, or a dedicated delayed phase through the heart, can show left atrial appendage thrombus, left ventricular thrombus after anterior myocardial infarction, and aortic arch atheroma thicker than a few millimeters. A left ventricular thrombus after an anterior infarction explains embolism to several territories and changes anticoagulation decisions, unlike the other findings listed.
Principle: Look for left ventricular thrombus after anterior MI in multiterritory stroke.

B4.3 Answer B
A recent small subcortical infarct is the acute diffusion-positive lesion of small vessel disease in one perforating artery territory. A lacune is its chronic cavity, a round or ovoid fluid-filled space between 3 and 15 mm, often with a rim of FLAIR hyperintensity. Perivascular spaces lack the FLAIR rim and follow cerebrospinal fluid without surrounding gliosis. A metastasis would enhance, and there is no blood.
Principle: A lacune is a 3 to 15 mm fluid cavity often with a FLAIR rim.

B4.4 Answer E
The distribution of microbleeds carries diagnostic meaning. Deep microbleeds in the basal ganglia, thalami, and brainstem accompany hypertensive arteriopathy, whereas strictly lobar microbleeds suggest cerebral amyloid angiopathy. Their presence changes the risk balance of antithrombotic and thrombolytic therapy, so the report counts them and describes their distribution. Axonal injury follows trauma, and cavernous malformations and septic emboli have different contexts.
Principle: Strictly lobar microbleeds suggest cerebral amyloid angiopathy.

B4.5 Answer C
Stenosis at the vertebral origin from the subclavian artery is common and often missed because the origin lies at the edge of many neck angiograms. In a patient with posterior circulation symptoms, the origins are inspected deliberately. Hypoplasia of one vertebral artery is a frequent variant that should not be mistaken for stenosis or occlusion. The other options either lie in a different circulation or do not cause posterior ischemia.
Principle: Inspect vertebral artery origins deliberately in posterior circulation symptoms.

B4.6 Answer D
Intracranial atherosclerosis of the middle cerebral artery, intracranial carotid, or basilar artery produces a characteristic pattern: perforator infarcts at the origin of small branches occluded by plaque, border zone infarcts beyond the stenosis from reduced flow, and occasional artery-to-artery emboli. High-resolution vessel wall imaging can show eccentric plaque. Cardioembolism produces scattered cortical infarcts, and the other conditions have different clinical and imaging features.
Principle: Perforator plus border zone infarcts beyond a stenosis suggest intracranial atherosclerosis.

B4.7 Answer C
Patent foramen ovale enters the reasoning when the infarct pattern is cortical or superficial and the patient is young. A large right-to-left shunt can be shown by transcranial Doppler or echocardiography with agitated saline, not by brain imaging. The radiologist contributes by describing infarcts that fit embolism and by excluding other causes, which supports referral for shunt assessment. The report names the infarct pattern clearly.
Principle: PFO is shown by bubble studies, not brain imaging.

B4.8 Answer E
Herpes simplex encephalitis can begin with acute aphasia and temporal lobe diffusion abnormality that resembles a posterior middle cerebral infarct. Involvement of the insula and cingulate gyrus, crossing arterial territories, and fever point to encephalitis. Recognizing the mimic matters because antiviral therapy must begin promptly, whereas thrombolysis would be inappropriate. The other options do not produce this distribution. Cerebrospinal fluid testing then confirms the cause.
Principle: Temporal, insular, and cingulate DWI change with fever suggests herpes encephalitis.

B4.9 Answer A
Chameleons are strokes that do not look like strokes, and they are the more dangerous error. Delirium or agitation without focal signs can come from a right hemispheric or thalamic infarct, and posterior circulation strokes can present with vertigo, nausea, or imbalance. Diffusion MRI identifies these infarcts. A pontine lacune with hemiparesis is a typical presentation rather than a chameleon.
Principle: Delirium without focal signs can be a right hemispheric or thalamic infarct.

B4.10 Answer B
A patient whose symptoms have resolved may still have an infarct on diffusion-weighted imaging. The presence of such a lesion reclassifies the event as a minor stroke and raises the short-term risk of recurrence, so it accelerates the search for a cause and secondary prevention. Imaging after transient symptoms therefore looks for acute infarction as well as for its source in the vessels and heart.
Principle: A DWI lesion after transient symptoms means minor stroke, not TIA.

Chapter 5: Intracerebral Hemorrhage and Cerebral Microbleeds

B5.1 Answer E
Intraventricular extension is described with the parenchymal hematoma. Blood that reaches the ventricles layers dependently in the occipital horns, may form a cast of the third or fourth ventricle, and can obstruct cerebrospinal fluid flow. Hydrocephalus is judged by the temporal horns, which dilate early, and by the size of the third ventricle. The blood level itself and the septum do not indicate obstruction, and the cisterna magna is irrelevant.
Principle: Judge early hydrocephalus by the temporal horns.

B5.2 Answer A
Several noncontrast CT signs reflect bleeding of different ages mixed within one clot and are associated with hematoma expansion. The swirl sign is a region of lower density within the hematoma, the blend sign is a sharply marginated junction between hypodense and hyperdense parts, and the black hole sign is a hypodense area completely enclosed by hyperdense blood. The spot sign requires CT angiography and is not seen on noncontrast images.
Principle: The blend sign is a sharp junction of hypodense and hyperdense blood.

B5.3 Answer D
Follow-up CT is timed to the risk of expansion. A first scan within a few hours of onset catches the period when expansion is most likely, and a second scan within the first day documents stability or growth. Growth is usually defined in studies as an absolute increase of more than 6 mL or a relative increase of more than a third. An increase of 9 mL meets both definitions, and the report states the volumes so the change is clear.
Principle: Hematoma growth: more than 6 mL or more than a third.

B5.4 Answer C
In a prospective study of 298 adults aged 18 to 70 years with nontraumatic intracerebral hemorrhage at 22 hospitals, a macrovascular cause was identified in 69 patients, 23%. Early CT angiography detected 51 of them, and later MRI and MR angiography or catheter angiography found additional causes. A normal early CT angiogram therefore does not end the search in a younger patient, particularly with a lobar hematoma.
Principle: Structured imaging finds a macrovascular cause in about a quarter of younger patients.

B5.5 Answer B
Hemorrhagic metastases from melanoma, renal cell carcinoma, thyroid carcinoma, and choriocarcinoma show enhancing tissue, disproportionate edema, and delayed evolution of blood products. Hemorrhagic transformation of an infarct follows an arterial territory, and coagulopathic hemorrhage often shows fluid levels. Hypertensive and amyloid hemorrhages do not have enhancing nodular tissue. Delayed MRI after the clot evolves often reveals the tumor. The report recommends that follow-up.
Principle: Enhancing tissue and disproportionate edema suggest a hemorrhagic metastasis.

B5.6 Answer D
Cerebellar hemorrhage is a surgical emergency in a way that supratentorial hemorrhage usually is not. A hematoma in the cerebellar hemisphere compresses the fourth ventricle and the brainstem, and obstructive hydrocephalus can develop within hours. The report measures the hematoma, describes the fourth ventricle as patent, compressed, or effaced, and comments on the basal cisterns and temporal horns, because these findings guide decisions about decompression.
Principle: Report fourth ventricle and brainstem compression in cerebellar hemorrhage.

B5.7 Answer B
Cortical superficial siderosis appears on susceptibility images as linear hypointensity along the gyral surface, the residue of repeated small bleeds into the subarachnoid space over the convexity. Transient focal neurological episodes, recurrent spreading sensory or motor symptoms, can accompany it and are a marker of cerebral amyloid angiopathy. Laminar necrosis is T1 bright, carcinomatosis enhances, and Sturge-Weber calcification occurs in children with a facial birthmark.
Principle: Gyral surface hypointensity on SWI is cortical superficial siderosis.

B5.8 Answer E
Several mimics must be excluded before a focus is counted as a microbleed. Flow voids in small vessels follow a linear course across adjacent slices. Calcification is dark on susceptibility images and bright on CT, and the phase image separates it from blood. Partial volume from bone and air near the skull base produces further artifacts. Counting only round foci that fulfill the criteria prevents overestimating the burden.
Principle: Linear flow voids and calcifications are microbleed mimics.

B5.9 Answer A
Distribution is interpreted with the clinical picture. Strictly lobar microbleeds point toward amyloid angiopathy, deep microbleeds toward hypertensive arteriopathy, and both together toward mixed disease. Deep microbleeds also exclude the strictly lobar pattern required by amyloid angiopathy criteria. The count is reported in broad bands, because one or two microbleeds are common in older adults while many suggest a higher risk.
Principle: Lobar plus deep microbleeds indicate mixed small vessel disease.

B5.10 Answer C
Susceptibility-weighted and gradient-echo sequences detect blood in every stage after the first hours, because deoxyhemoglobin, methemoglobin inside cells, and hemosiderin are all paramagnetic. They make MRI as sensitive as CT for acute hemorrhage and far more sensitive for old hemorrhage. A short MRI protocol in suspected stroke therefore includes one, alongside diffusion and FLAIR, and it also reveals microbleeds that inform the cause.
Principle: Paramagnetic blood products make SWI sensitive to hemorrhage of all ages.

Chapter 6: Subarachnoid Hemorrhage and Intracranial Aneurysms

B6.1 Answer E
Where the blood collects guides the search for the aneurysm. Blood centered in the interhemispheric fissure and gyrus rectus suggests an anterior communicating artery aneurysm, blood in one sylvian fissure suggests a middle cerebral bifurcation aneurysm, and blood in the prepontine cistern and fourth ventricle suggests a posterior circulation source. All vessels are still reviewed, because multiple aneurysms are common, but the distribution focuses the first look.
Principle: Interhemispheric and gyrus rectus blood points to an AComm aneurysm.

B6.2 Answer B
MRI with FLAIR and susceptibility imaging detects subarachnoid blood with high sensitivity, particularly days after onset when CT has normalized. However, FLAIR sulcal hyperintensity has many other causes, including meningitis, supplemental oxygen, propofol, and artifact. Lumbar puncture with inspection for xanthochromia remains the reference when CT is negative late after onset. Susceptibility images help, because blood products cause blooming that oxygen and propofol do not.
Principle: FLAIR sulcal hyperintensity is sensitive but not specific for blood.

B6.3 Answer C
Vasospasm peaks between the fourth and fourteenth days after hemorrhage. CT angiography and digital subtraction angiography show narrowing of the proximal arteries, CT perfusion shows delayed transit in the dependent territory, and transcranial Doppler measures rising velocities at the bedside. Delayed cerebral ischemia is the clinical consequence. A new deficit on day 7 calls for angiographic and perfusion imaging rather than noncontrast CT alone.
Principle: Days 4 to 14: look for vasospasm with CTA and perfusion.

B6.4 Answer D
Rebleeding is the complication of the first day. It is most frequent in the hours after the initial hemorrhage and before the aneurysm is secured, and it is recognized on CT as new blood, often with a larger hematoma or intraventricular extension. That risk is why aneurysm treatment is arranged urgently. Vasospasm occurs later, between days 4 and 14, and hydrocephalus or edema would not add new blood.
Principle: New blood within hours, before treatment, means rebleeding.

B6.5 Answer A
Treatment planning needs the aneurysm described in its own terms: location by parent artery and segment, dome size, neck width, the ratio of dome to neck, the direction of projection, daughter sacs or lobulation, and the branches that arise from the neck or the dome. These determine whether coiling, stent assistance, or clipping is feasible. A single diameter leaves the surgeon without the measurements that guide the choice.
Principle: Describe dome, neck, ratio, projection, lobulation, and branches.

B6.6 Answer D
After coiling, follow-up imaging looks for recanalization at the neck. MR angiography with time-of-flight and contrast-enhanced sequences shows residual flow around the coil mass with less artifact than CT, where metal streak obscures the neck. After clipping, CT angiography is degraded near the clip, and catheter angiography is used when a remnant matters. Noncontrast CT, radiographs, and ultrasound cannot show recanalization.
Principle: MR angiography is preferred to follow coiled aneurysms.

B6.7 Answer C
Mycotic and traumatic aneurysms break the usual rules. Infectious aneurysms from septic emboli sit in distal branches, often near the cortical surface, and can appear, grow, or resolve within weeks on antibiotic treatment. A new distal aneurysm in a patient with suspected endocarditis fits this pattern. Berry aneurysms arise at proximal branch points, traumatic pseudoaneurysms follow injury, and blister aneurysms occur on the supraclinoid carotid.
Principle: New distal cortical aneurysm with endocarditis suggests a mycotic aneurysm.

B6.8 Answer B
In a pooled analysis of six prospective cohorts, the mean observed 5-year risk of rupture was 3.4%. Predictors were age, hypertension, history of subarachnoid hemorrhage, aneurysm size, aneurysm location, and geographical region, and those factors form the PHASES score used to individualize risk. The average figure applies to the pooled population, so the score and growth on follow-up refine the estimate for each patient.
Principle: The mean 5-year rupture risk was 3.4% in pooled cohorts.

B6.9 Answer E
Convexity subarachnoid hemorrhage is a different entity from aneurysmal hemorrhage: blood in a few sulci over the hemispheric surface, sparing the basal cisterns. In younger patients it suggests reversible cerebral vasoconstriction syndrome, and in older patients cerebral amyloid angiopathy, especially when lobar microbleeds or siderosis are present. Aneurysmal and perimesencephalic hemorrhages fill the basal cisterns, and apoplexy is sellar. Imaging decides the next test.
Principle: Convexity SAH in older adults suggests amyloid angiopathy.

B6.10 Answer A

Clinical grade is recorded beside the imaging grade. The Hunt and Hess and World Federation of Neurosurgical Societies scales describe the patient's level of consciousness and deficits, and together with the modified Fisher grade they frame prognosis and the urgency of treatment. ASPECTS and NIHSS apply to ischemic stroke, the ICH score to parenchymal hemorrhage, Fazekas and Koedam to white matter and atrophy, and Bern and Knosp to other conditions.

Principle: Record Hunt and Hess or WFNS beside the modified Fisher grade.

Chapter 7: Vascular Malformations

B7.1 Answer A

Angiographic features that raise the risk of hemorrhage are reported beside the surgical grade. Intranidal and flow-related aneurysms on feeding arteries, venous stenosis or ectasia, and a single draining vein all appear on the risk list in different series, and a deep location changes both the bleeding risk and the treatment options. The grade estimates operative risk, while these features inform the natural history, and both are needed for decisions.

Principle: Report feeder aneurysms and venous stenosis as hemorrhage risk features.

B7.2 Answer D

Functional imaging and tractography refine the eloquence judgment before treatment. Functional MRI maps motor and language cortex, although blood flow in and around the nidus can distort the signal, and diffusion tensor tractography shows the course of the corticospinal tract and optic radiation relative to the lesion. Eloquence is one of the three features of the surgical grade, so these maps can change the estimated risk and the approach.

Principle: fMRI and tractography refine eloquence assessment for AVM surgery.

B7.3 Answer E

Cortical venous drainage is the finding that matters most in a dural fistula, and it is also the hardest to see on cross-sectional imaging. Dilated cortical veins on susceptibility images, prominent flow voids on the brain surface, enhancing tortuous vessels, and venous congestion edema in the white matter suggest it. Cortical venous reflux carries a risk of hemorrhage and neurological deficit, so these signs prompt catheter angiography and treatment.

Principle: Dilated cortical veins and congestive edema imply cortical venous drainage.

B7.4 Answer C

Carotid-cavernous fistulas form a special group. Direct high-flow fistulas follow trauma and cause pulsatile proptosis, chemosis, and bruit, whereas indirect dural fistulas of the cavernous sinus are slower and present with red eye and diplopia. Imaging shows an enlarged superior ophthalmic vein, proptosis, enlarged extraocular muscles, and sometimes a bulging cavernous sinus. Thyroid eye disease does not enlarge the ophthalmic vein in this way.

Principle: Red eye, diplopia, and a dilated SOV suggest an indirect CCF.

B7.5 Answer B

Cavernous malformations occur in a sporadic form with isolated lesions and a familial form with multiple lesions and autosomal dominant inheritance. In six affected families followed prospectively, serial MRI over a mean of 2.2 years showed 17 new lesions in six of 21 patients. Susceptibility-weighted imaging is the most sensitive sequence for counting them, and the report notes the number and any recent hemorrhage.

Principle: Familial cavernous malformations develop new lesions over time.

B7.6 Answer B

Follow-up of cavernous malformations is symptom-driven, and routine serial imaging of an asymptomatic sporadic lesion adds little. Radiation therapy to the brain, particularly in childhood, can induce new cavernous malformations years later, and these appear as foci of susceptibility signal loss within the treated field. Recognizing them avoids confusion with recurrent tumor or metastases, which enhance, and amyloid angiopathy, which affects older adults.

Principle: Childhood brain irradiation can induce cavernous malformations years later.

B7.7 Answer A

A cavernous malformation is often found next to a developmental venous anomaly. Hemorrhage near one is far more likely to come from the cavernous malformation than from the venous anomaly itself, which is usually a normal variant draining functioning brain. Rarely, thrombosis of the collecting vein causes venous infarction or hemorrhage. The distinction matters because the venous anomaly must not be removed.

Principle: Hemorrhage near a DVA usually comes from an associated cavernous malformation.

B7.8 Answer E

After radiosurgery, the nidus obliterates over two to three years. Follow-up MRI tracks shrinkage of flow voids, and catheter angiography confirms obliteration. Radiation-induced changes, including edema, enhancement, and later cyst formation, can appear months to years after treatment and are reported as treatment effects rather than as recurrence. Their severity is described so that corticosteroids can be considered if symptoms develop.

Principle: Edema and enhancement after AVM radiosurgery are treatment effects.

B7.9 Answer D

Spinal dural fistulas, the commonest spinal vascular malformation, are often missed. They present in older men with slowly progressive myelopathy, and MRI shows a long segment of central cord T2 hyperintensity with dilated perimedullary veins as flow voids along the dorsal surface of the cord. The fistula itself lies at a nerve root sleeve, and spinal angiography localizes it for treatment.

Principle: Long central cord edema with dorsal flow voids suggests a spinal dural fistula.

B7.10 Answer C

Capillary telangiectasias are small clusters of dilated capillaries, most often in the pons. They are usually invisible on unenhanced images, enhance faintly in a brushlike pattern, and lose signal on susceptibility imaging because of deoxyhemoglobin in slowly flowing blood rather than hemosiderin. They are almost always incidental, and recognizing them avoids unnecessary concern about tumor or demyelination. They need no follow-up imaging.

Principle: Telangiectasias darken on SWI from deoxyhemoglobin, not hemosiderin.

Chapter 8: Dissection, Vasculopathy, and Cerebral Venous Thrombosis

B8.1 Answer D

Dissection of the vertebral artery occurs most often in its V3 segment as it loops around the atlas, and occasionally intradurally in V4, where a dissection can extend into the basilar artery or rupture into the subarachnoid space. V1 is the origin segment and V2 runs through the transverse foramina. Naming the segment matters because intradural extension changes the risk of subarachnoid hemorrhage and the approach to treatment.

Principle: Vertebral dissection most often involves V3 around the atlas.

B8.2 Answer B
Follow-up imaging at three to six months after dissection shows recanalization in many cases, persistent stenosis in some, and stable pseudoaneurysms in others. Most pseudoaneurysms are left alone. A new pseudoaneurysm or progression of stenosis is reported with measurements that allow comparison on later studies. Stable lesions rarely cause problems, so the report describes them without implying a need for intervention.
Principle: Stable dissecting pseudoaneurysms are usually managed conservatively.

B8.3 Answer C
Fibromuscular dysplasia is the main nonatherosclerotic mimic and a frequent companion of dissection. Its common multifocal form produces a string of beads in the mid and distal cervical internal carotid and vertebral arteries, away from the bifurcation, while the focal form produces a smooth tubular stenosis. Atherosclerosis favors the bifurcation, and the other conditions involve different segments. Finding it prompts screening of other territories, such as the renal arteries.
Principle: A string of beads away from the bifurcation suggests multifocal FMD.

B8.4 Answer A
Vessel wall patterns help most. Atherosclerotic plaque is eccentric with heterogeneous or focal enhancement at sites of predilection. Vasculitis produces smooth, concentric wall thickening with intense enhancement, often in several segments in different territories, and may involve small distal branches beyond the resolution of the technique. Reversible vasoconstriction shows little or no wall enhancement, and dissection is usually single. Biopsy may be needed.
Principle: Concentric multisegment wall enhancement favors vasculitis.

B8.5 Answer E
Vessel wall imaging has limits. Slow flow can mimic wall enhancement, the arteries are small relative to voxel size, and enhancement in the wall of a recently occluded artery can follow thrombus rather than disease. Images are acquired before and after contrast with matched parameters, and the report states the segments examined and the limitations. Enhancement in a recently occluded segment alone does not establish vasculitis.
Principle: Wall enhancement in a recently occluded artery may reflect thrombus.

B8.6 Answer B
After hemorrhage, wall imaging helps identify the culprit. When several aneurysms are present, wall enhancement in one of them has been associated with instability and can point to the ruptured lesion. When an intracranial dissection is suspected, an intramural hematoma and a double lumen can be seen. The finding supports, rather than replaces, the bleeding pattern and aneurysm morphology. It also guides treatment order.
Principle: Aneurysm wall enhancement suggests instability among multiple aneurysms.

B8.7 Answer C
Posterior reversible encephalopathy and reversible vasoconstriction overlap more than their names suggest. Both follow the postpartum state, hypertensive crises, and certain drugs, and some patients have both vasogenic edema in the parieto-occipital white matter and segmental arterial narrowing. Imaging both the parenchyma and the arteries captures the full picture, guides management, and documents resolution on follow-up. Both usually resolve with treatment.
Principle: PRES and RCVS overlap; image both parenchyma and arteries.

B8.8 Answer D
Moyamoya means a puff of smoke and describes the angiographic appearance of basal collaterals that develop as the carotid termini close; on MRI they appear as multiple small flow voids in the basal ganglia and thalami. Children usually present with ischemic events, often triggered by crying or hyperventilation, while adults more often present with hemorrhage from fragile collaterals. Perfusion and reserve studies help select patients for revascularization.
Principle: Moyamoya: ischemia in children, hemorrhage more often in adults.

B8.9 Answer A
Noncontrast CT may show a hyperdense sinus or cortical vein, the dense triangle in the posterior superior sagittal sinus, or the cord sign of a thrombosed cortical vein. After contrast, the empty delta sign is a filling defect in the sinus surrounded by enhancing dura. The string of beads describes fibromuscular dysplasia or vasoconstriction, and the ivy sign refers to leptomeningeal collaterals in moyamoya.
Principle: A contrast-enhanced filling defect in the sinus is the empty delta sign.

B8.10 Answer E
The outcome of cerebral venous thrombosis is better than its imaging often suggests. In the International Study on Cerebral Vein and Dural Sinus Thrombosis of 624 adults, 57.1% had no symptoms or signs at a median follow-up of 16 months, and 8.3% had died. Hemorrhage on admission CT and deep venous thrombosis predicted death or dependence, so the report states them, but most patients recover well.
Principle: Most patients with CVT recover without residual symptoms.

Chapter 9: Traumatic Brain Injury

B9.1 Answer C
The report on a trauma head CT follows a strict order: extra-axial collections with their thickness, parenchymal hemorrhage, subarachnoid and intraventricular blood, midline shift in millimeters, the state of the basal cisterns, signs of herniation, and fractures. Leading with the collections and their thickness gives the neurosurgeon the findings that decide surgery. Incidental findings come at the end. Fractures come later.
Principle: Lead a trauma CT report with extra-axial collections and their thickness.

B9.2 Answer B
Chronic subdural hematomas are a disease of older adults, often after a trivial or forgotten injury, and of patients on anticoagulant or antiplatelet therapy. Brain atrophy stretches the bridging veins and leaves room for a collection to grow slowly before symptoms appear. Septations and layering of blood of different ages are typical. Middle meningeal artery rupture produces an epidural hematoma, usually with a fracture.
Principle: Atrophy stretches bridging veins and allows chronic subdurals to grow.

B9.3 Answer E
Traumatic subarachnoid hemorrhage collects in sulci near contusions and in the sylvian fissures and interpeduncular cistern, and its pattern usually differs from aneurysmal hemorrhage, which fills the basal cisterns. When the history is uncertain, as in a patient found collapsed, a basal cisternal pattern prompts CT angiography, because the aneurysm may have ruptured first and caused the fall. Missing it would delay securing the aneurysm.
Principle: Basal cisternal SAH after an unwitnessed fall warrants CT angiography.

B9.4 Answer A
Contusions are multiple, superficial, and wedge-shaped toward the cortical surface, with a salt-and-pepper mixture of blood and edema rather than a single round clot. A large frontal or temporal contusion can behave like a mass, and temporal lobe contusions are especially dangerous because their proximity to the tentorium allows uncal herniation with relatively little volume. Contusions also often enlarge on follow-up CT.
Principle: Temporal contusions can cause uncal herniation with little volume.

B9.5 Answer D
Diffuse axonal injury results from rotational acceleration that shears axons at interfaces of different tissue density. It favors the gray-white junction of the frontal and temporal lobes, the corpus callosum, particularly the splenium, and the dorsolateral brainstem in the most severe cases. CT is often normal or shows only a few small hemorrhages, so coma out of proportion to CT findings calls for MRI with diffusion and susceptibility imaging.
Principle: Rotational acceleration shears axons at gray-white junctions and the callosum.

B9.6 Answer C
Advanced techniques such as diffusion tensor imaging, functional MRI, spectroscopy, perfusion imaging, and PET are of particular interest for identifying further injury when conventional CT and MRI findings are normal. The data available confine their use to research and group comparisons rather than decisions in individual patients. A normal conventional study does not exclude a mild injury, but advanced findings in one person cannot prove it.
Principle: Advanced TBI imaging remains a research and group-comparison tool.

B9.7 Answer B
Secondary injury develops after the first scan. Swelling, ischemia from raised intracranial pressure, and hematoma expansion are watched on follow-up imaging, and effacement of the basal cisterns is the finding that best tracks dangerous intracranial pressure. The cisterns are therefore described on every trauma CT. Scalp swelling, mastoid fluid, and calcification do not reflect pressure. Shift is also measured. Both are compared with prior scans.
Principle: Basal cistern effacement best tracks dangerous intracranial pressure.

B9.8 Answer E
Skull base fractures carry their own complications. Fractures through the sphenoid sinus or the clivus can injure the internal carotid artery, those through the temporal bone can injure the facial nerve, ossicles, and labyrinth, and those through the cribriform plate or the posterior wall of the frontal sinus open a route for cerebrospinal fluid leak and meningitis. Rhinorrhea after this fracture pattern supports a leak.
Principle: Cribriform and posterior frontal sinus fractures risk CSF leak and meningitis.

B9.9 Answer A
Penetrating injuries add their own patterns. A missile track appears as a linear hemorrhagic tract with bone and metal fragments, often with hemorrhage and edema along its length, and fragments that cross the midline or traverse the ventricles predict a poor outcome. Vascular injury, with pseudoaneurysm formation along the tract, is also sought with CT angiography, because traumatic pseudoaneurysms can rupture later.
Principle: Missile fragments crossing midline or ventricles predict poor outcome.

B9.10 Answer D

Screening criteria identify patients at risk of blunt cerebrovascular injury: cervical spine fractures, especially through the transverse foramen or with subluxation, Le Fort II or III facial fractures, skull base fractures involving the carotid canal, severe diffuse axonal injury, near-hanging, and seatbelt abrasions across the neck. CT angiography of the neck is the screening test, because early detection allows treatment before stroke occurs.

Principle: Seatbelt neck abrasion or Le Fort II-III fractures warrant neck CTA.

Chapter 10: Herniation, Hypoxic-Ischemic Injury, and Death by Neurologic Criteria

B10.1 Answer D

Descending transtentorial herniation pushes the medial temporal lobe over the tentorial edge. The earliest sign is effacement of the ipsilateral suprasellar and ambient cisterns by the uncus, followed by displacement of the midbrain and widening of the contralateral cistern. Pontine hemorrhage is a late Duret phenomenon, and upward vermian displacement indicates ascending herniation. Recognizing early cistern effacement allows treatment before brainstem compression.

Principle: Ipsilateral suprasellar and ambient cistern effacement is the earliest uncal sign.

B10.2 Answer C

Central descending herniation displaces the diencephalon and midbrain downward, stretches the perforating branches of the basilar artery, and causes Duret hemorrhages in the pons and midbrain. They indicate severe, often terminal herniation. Kernohan notch refers to compression of the opposite cerebral peduncle against the tentorium, shear hemorrhages follow rotational trauma, and venous hemorrhages follow sinus thrombosis. The report names them as a grave finding.

Principle: Duret hemorrhages result from downward herniation stretching basilar perforators.

B10.3 Answer E

Extracranial herniation through a craniectomy or skull defect completes the classification of herniation. After decompression, brain swelling bulges through the defect and the cortical veins at its margin can be kinked, producing venous infarction and hemorrhage. Paradoxical herniation, a shift toward the side of a craniectomy, can occur later when the brain sinks. The report describes the herniated volume and margin changes.

Principle: Brain herniating through a craniectomy can kink veins and cause venous infarction.

B10.4 Answer B

Diffusion-weighted imaging is the most sensitive early sequence after hypoxic-ischemic injury. Restricted diffusion appears in the cortex, especially the occipital and perirolandic regions, the basal ganglia, and the thalami within hours, and it peaks over the first days before pseudonormalizing after about a week. CT is often normal in the first hours, and the other sequences do not show the cytotoxic injury as early.

Principle: Diffusion imaging is most sensitive early after cardiac arrest.

B10.5 Answer A

Because conventional imaging may be subtle or absent in the acute setting, particularly in neonates, magnetic resonance spectroscopy can help establish the diagnosis. A lactate peak and a falling N-acetylaspartate concentration indicate anaerobic metabolism and neuronal loss. Normal N-acetylaspartate argues against severe injury, and scalp lipid contamination reflects poor voxel placement rather than disease. It is acquired in the deep gray matter.

Principle: Lactate and falling NAA on spectroscopy support neonatal HIE.

B10.6 Answer C
Quantitative measures support the visual impression after cardiac arrest. The ratio of gray matter to white matter attenuation at the level of the basal ganglia and centrum semiovale falls as edema erases the normal density difference, and the apparent diffusion coefficient can be averaged across the brain to give a volume of tissue below a threshold. These measures are integrated with clinical assessment rather than used alone.
Principle: A falling gray-white attenuation ratio quantifies post-arrest edema.

B10.7 Answer A
A useful report describes the distribution and extent of injury rather than offering a prognosis by itself. It states which regions show restricted diffusion, whether the deep gray matter is involved, whether diffuse edema with effacement of the basal cisterns is present, and whether herniation has begun. Confounders are named. Targeted temperature management changes the timing of clinical examination, so imaging is integrated with other strands of assessment.
Principle: Describe injury distribution and confounders; do not prognosticate alone.

B10.8 Answer D
Carbon monoxide binds hemoglobin and cytochrome oxidase, and the globus pallidus, with its high iron content and borderline perfusion, is its classic target, often bilateral and symmetric with restricted diffusion in the acute phase. The cortex, hippocampi, and white matter can also be affected. Methanol injures the putamina with hemorrhage, inhaled heroin causes a spongiform leukoencephalopathy, and metronidazole affects the dentate nuclei.
Principle: Bilateral pallidal injury suggests carbon monoxide poisoning.

B10.9 Answer E
Imaging ancillary tests show absent cerebral blood flow. Catheter angiography shows contrast stopping at the skull base with no intracranial filling. Radionuclide perfusion scintigraphy shows absent uptake in the brain, the empty skull, sometimes with the hot nose sign from external carotid shunting. Any intracranial uptake, including cerebellar uptake, would not support absent flow. The report states whether criteria are met.
Principle: Absent intracranial uptake, the empty skull, supports absent flow.

B10.10 Answer B
CT angiography criteria for absent flow focus on the cortical branches of the middle cerebral arteries and the internal cerebral veins, the vessels that fill last when intracranial pressure approaches arterial pressure. Opacification of proximal segments alone, the stasis filling that results from slow entry under high pressure, does not indicate preserved flow. The report describes the study precisely and states whether it meets institutional criteria.
Principle: Proximal stasis filling alone does not mean preserved cerebral flow.

Chapter 11: Adult Gliomas and the WHO Classification

B11.1 Answer E
A nonenhancing infiltrative lesion in an older adult may already be a glioblastoma by molecular criteria, so the absence of enhancement does not justify a low-grade label in the report. Age, location, diffusion, and perfusion are combined with enhancement rather than replaced by it. Restricted diffusion and high blood volume in an older patient raise the possibility of an IDH-wildtype glioblastoma at an early stage.
Principle: Absent enhancement does not mean low grade in an older adult.

B11.2 Answer C
Circumscribed astrocytic gliomas form a separate group that should not be mistaken for diffuse glioma. Pilocytic astrocytoma, common in the cerebellum of children and young adults, is a cyst with an enhancing mural nodule. Its enhancement does not indicate high grade. Diffuse midline glioma involves the brainstem or thalamus, glioblastoma has necrosis and a thick rim in older adults, and neurocytoma is intraventricular.
Principle: A cerebellar cyst with an enhancing nodule in a young patient suggests pilocytic astrocytoma.

B11.3 Answer A
Grade is hinted at but not settled by imaging. Enhancement, necrosis, and high relative cerebral blood volume in an IDH-mutant tumor suggest higher grade, but oligodendrogliomas can enhance and show high blood volume at grade 2 because of their dense capillary network. A rising blood volume or new enhancement on surveillance is more informative than a single value. Cortical involvement and gyral expansion also favor oligodendroglioma.
Principle: Grade 2 oligodendrogliomas can have high blood volume from dense capillaries.

B11.4 Answer B
Glioblastoma's imaging appearance reflects aggressive biology: a thick irregular rim of enhancement around central necrosis, surrounding T2 and FLAIR hyperintensity that mixes vasogenic edema with infiltrating tumor, mass effect, and frequent spread across the corpus callosum to produce a butterfly pattern. Lymphoma can also cross the callosum, but usually enhances homogeneously without necrosis. Dawson fingers, tram-track, and trident patterns describe other diseases.
Principle: Callosal crossing with bilateral extension is the butterfly pattern of glioblastoma.

B11.5 Answer D
Leptomeningeal and ependymal spread of glioblastoma occur late but change the prognosis. They are sought on postcontrast FLAIR and three-dimensional T1-weighted images along the ventricular walls and the cerebellar folia, and imaging of the spine is added when symptoms suggest drop metastases. Ependymal enhancement with new back pain and leg weakness therefore calls for contrast-enhanced spine MRI. Cerebrospinal fluid cytology may follow.
Principle: Spinal symptoms in glioblastoma warrant imaging for drop metastases.

B11.6 Answer E
Spectroscopy shows the metabolic signature of glioma: raised choline, reduced N-acetylaspartate, and lactate or lipid in necrotic tumors. A specific peak of 2-hydroxyglutarate can be detected in IDH-mutant tumors with tailored sequences, offering a noninvasive marker of the mutation in centers that perform it. N-acetylaspartate, creatine, myo-inositol, and glutamine are not specific markers of the mutation. A negative study does not exclude it.
Principle: 2-hydroxyglutarate on tailored MRS marks IDH-mutant glioma.

B11.7 Answer D
The extent of resection is measured on early postoperative MRI, ideally within 48 to 72 hours, before reactive enhancement develops along the resection margin. Diffusion-weighted images in the same study show restricted diffusion around the cavity that represents surgical injury and will enhance weeks later. Recording this prevents later enhancement from being mistaken for recurrent tumor. Later studies are compared with it.
Principle: Obtain postoperative glioma MRI within 48 to 72 hours.

B11.8 Answer B
Diffusion-weighted images on early postoperative MRI show areas of restricted diffusion around the cavity that represent surgical injury and that will enhance weeks later. Enhancement appearing in exactly those areas is expected evolution of the injury rather than tumor, and comparison with the early study prevents a false diagnosis of recurrence. Radiation necrosis appears months to years later, and an abscess would show central restricted diffusion with clinical signs.
Principle: Enhancement where early postoperative DWI restricted is evolving surgical injury.

B11.9 Answer A
Diffusion tensor tractography and functional MRI map eloquent tracts and cortex before surgery, and the report states the relation of the tumor to the corticospinal tract, the arcuate fasciculus, and the optic radiation when surgery is planned. These relationships guide the extent of safe resection and intraoperative mapping. Skull thickness, sinus size, pineal position, and the falx do not affect the functional plan.
Principle: State the tumor's relation to key tracts before glioma surgery.

B11.10 Answer C
Perfusion imaging adds a measure of neovascularity. Dynamic susceptibility contrast perfusion with leakage correction gives relative cerebral blood volume maps in which high values favor high-grade tumor and guide biopsy toward the most aggressive region. Dynamic contrast-enhanced perfusion measures permeability, and arterial spin labeling measures blood flow without contrast. Time-of-flight and phase-contrast imaging assess vessels and flow, not tissue blood volume.
Principle: DSC perfusion with leakage correction maps rCBV to target biopsy.

Chapter 12: Meningiomas and Other Extra-Axial Tumors

B12.1 Answer C
Dural-based masses can arise from tissues other than the meninges. Metastases from breast, prostate, and lung cancer can cause a dural tail and even hyperostosis, but they more often destroy bone, grow quickly, and appear in several places. A history of malignancy, multiplicity, and bone destruction therefore favor metastasis. Arachnoid and epidermoid cysts do not enhance, and hemangioblastoma is an intra-axial cystic lesion with a nodule.
Principle: Multiplicity, cancer history, and bone destruction favor dural metastases.

B12.2 Answer E
Location shapes both the presentation and the surgery. Olfactory groove and planum meningiomas grow large before they cause anosmia or frontal symptoms, whereas tuberculum sellae meningiomas compress the optic chiasm early, and sphenoid wing meningiomas range from globular masses to flat en plaque tumors that thicken bone. A large olfactory groove tumor with frontal behavior change fits this pattern, and the report describes the frontal lobes and optic apparatus.
Principle: Olfactory groove meningiomas grow large before symptoms appear.

B12.3 Answer A
Sphenoid wing meningiomas range from globular masses to flat en plaque tumors that thicken bone and cause proptosis. The hyperostotic bone may be the most visible part of the tumor, and the thin enhancing dural component confirms it. Olfactory groove tumors arise anteriorly in the midline, tuberculum sellae tumors compress the chiasm, and intraventricular and angle tumors lie elsewhere. Fibrous dysplasia can mimic the bone change but lacks the dural component.
Principle: En plaque sphenoid wing meningioma thickens bone and causes proptosis.

B12.4 Answer D
Radiotherapy and radiosurgery are used for residual or recurrent tumor and for lesions in hazardous locations such as the cavernous sinus. Treated meningiomas often stop growing but rarely disappear, and a decrease in enhancement or central necrosis after treatment is an expected response. Stable size with reduced enhancement does not indicate progression, and the report compares measurements with the pretreatment baseline.
Principle: Reduced enhancement or central necrosis after radiosurgery is an expected response.

B12.5 Answer B
Multiple meningiomas suggest neurofibromatosis type 2 or schwannomatosis when they appear in a young adult, especially with bilateral vestibular schwannomas, and prior cranial irradiation raises the incidence of meningiomas decades later. Radiation-induced meningiomas are more often multiple and of higher grade. The history therefore explains both the number and the aggressive feature, and surveillance of all lesions is needed. Imaging of the whole neuraxis may be considered.
Principle: Radiation-induced meningiomas are more often multiple and higher grade.

B12.6 Answer D
Schwannomas of the cranial nerves are extra-axial masses that follow the course of the nerve. The vestibular schwannoma fills and widens the internal auditory canal, and trigeminal schwannomas form dumbbell masses spanning the middle and posterior fossae through Meckel cave. Unlike meningioma, schwannomas rarely calcify and often contain cysts. Epidermoid and arachnoid cysts do not enhance, and chordoma arises in the clivus.
Principle: A dumbbell mass through Meckel cave suggests trigeminal schwannoma.

B12.7 Answer A
Extra-axial and ventricular cysts are identified by location and signal. Neurenteric cysts lie anterior to the brainstem and are often hyperintense on T1 from protein, while colloid cysts sit at the foramen of Monro and can cause sudden hydrocephalus. Choroid fissure cysts are common incidental findings, arachnoid cysts follow cerebrospinal fluid, and pineal cysts lie behind the third ventricle. Symptoms with positional change and ventricular enlargement call for urgent neurosurgical review.
Principle: A hyperdense cyst at the foramen of Monro is a colloid cyst.

B12.8 Answer B
The report on a meningioma under surveillance measures it the same way every time, preferably as a volume or in three orthogonal diameters, and states the presence or absence of edema and any growth since the first study. Comparing with the first study, not only the most recent, reveals slow growth that small interval changes hide. Calcification, low T2 signal, and absent edema suggest slow growth.
Principle: Measure meningiomas the same way each time and compare with the first study.

B12.9 Answer C
Imaging features suggest higher grade: irregular or mushrooming margins, heterogeneous enhancement with necrosis, restricted diffusion, extensive peritumoral edema, invasion of the brain, and destruction of bone favor atypical or anaplastic tumors, although none of these is reliable on its own. Grade is assigned by pathology, now including molecular markers such as TERT promoter mutation and CDKN2A/B deletion, which imaging cannot see.
Principle: Mushrooming margins, necrosis, and restricted diffusion suggest higher-grade meningioma.

B12.10 Answer E

Dural-based masses can arise from tissues other than the meninges. Sarcoidosis and IgG4-related disease produce thick, smooth or nodular dural thickening that can mimic meningioma, and systemic findings such as hilar adenopathy support sarcoidosis. Lymphoma of the dura enhances homogeneously and restricts diffusion. Multiple meningiomas form discrete masses, and the cysts and hemangioblastomas listed do not produce diffuse dural thickening.

Principle: Diffuse thick dural enhancement with systemic disease suggests sarcoidosis or IgG4 disease.

Chapter 13: Brain Metastases, Lymphoma, and Leptomeningeal Disease

B13.1 Answer D

Hemorrhage is common in metastases from melanoma, renal cell carcinoma, thyroid carcinoma, and choriocarcinoma, and these sources are considered when a hemorrhagic lesion appears in a patient with or without a known cancer. Hemorrhagic metastases show enhancing tissue and disproportionate edema, which separate them from simple hypertensive hemorrhage. The other groups metastasize to the brain less often or rarely bleed.

Principle: Melanoma, renal, thyroid, and choriocarcinoma metastases often bleed.

B13.2 Answer C

Detection of metastases depends on technique. Thin-section three-dimensional T1-weighted imaging after contrast finds more and smaller metastases than thick two-dimensional slices, and spin-echo based three-dimensional sequences suppress the signal of small vessels that can mimic tiny lesions on gradient-echo images. A delay between injection and acquisition also increases conspicuity. Comparing adjacent slices helps confirm whether a dot is linear and vascular.

Principle: Spin-echo 3D T1 suppresses vessels that mimic tiny metastases.

B13.3 Answer E

The report counts the lesions, gives the largest dimensions of the main ones, notes hemorrhage and mass effect, and identifies lesions near eloquent structures or in the posterior fossa, where edema threatens the fourth ventricle. Compression of the fourth ventricle can cause obstructive hydrocephalus and may change the order of treatment, favoring resection before radiation. The other details do not alter management.

Principle: Report fourth ventricle compression from posterior fossa metastases.

B13.4 Answer B

For patients with asymptomatic metastases and no systemic therapy options, the guideline recommends stereotactic radiosurgery alone for one to four unresected metastases, excluding small-cell lung carcinoma, and also recommends radiosurgery alone to the surgical cavity for patients with one or two resected metastases. Cavity radiosurgery reduces local recurrence while sparing the cognitive cost of whole-brain treatment, which if used is combined with memantine and hippocampal avoidance.

Principle: After resection of one or two metastases, treat the cavity with radiosurgery.

B13.5 Answer A

In a randomized trial of 213 patients with one to three metastases, radiosurgery alone produced less cognitive deterioration than radiosurgery with whole-brain radiotherapy, but time to intracranial failure was shorter with radiosurgery alone, and overall survival did not differ significantly. The tradeoff, better cognition against more frequent new lesions, makes close MRI surveillance after radiosurgery part of the treatment, so a new small lesion is treated when found.

Principle: Radiosurgery alone trades better cognition for more new lesions.

B13.6 Answer C
Systemic agents that cross the blood-brain barrier, including targeted therapies for EGFR-mutant and ALK-rearranged lung cancer and immune checkpoint inhibitors in melanoma, now shrink some metastases without radiation, which makes measurement on comparable sequences essential. Standardized response criteria and a consistent protocol allow true change to be separated from technical variation. Stopping imaging would miss intracranial progression. Lesion counts are also compared.
Principle: Systemic therapy response demands measurement on comparable sequences.

B13.7 Answer D
Primary central nervous system lymphoma in immunocompetent adults typically forms one or a few masses in the periventricular white matter, corpus callosum, or deep gray matter that are hyperdense on CT, iso to hypointense on T2-weighted images, and markedly restricted on diffusion imaging because of dense cellularity. The same cellularity explains the CT density. Calcification and hemorrhage are uncommon, and the tumor contains no fat.
Principle: Dense cellularity makes lymphoma hyperdense on CT and restricted on DWI.

B13.8 Answer E
Treatment of primary central nervous system lymphoma is chemotherapy rather than resection. Staging includes examination of the eyes, cerebrospinal fluid, and the body to exclude systemic lymphoma, and response is measured on MRI. Vitreoretinal involvement accompanies a proportion of cases, cerebrospinal fluid may contain tumor cells, and systemic disease would change the diagnosis to secondary involvement. Biopsy precedes corticosteroids when possible.
Principle: Stage PCNSL with eye examination, CSF analysis, and body imaging.

B13.9 Answer B
Lumbar puncture before MRI can produce diffuse dural enhancement from intracranial hypotension, so imaging comes first when possible. Pachymeningeal enhancement, thick and smooth along the dura, has a different differential from leptomeningeal enhancement, including intracranial hypotension, postoperative change, and dural metastases, while leptomeningeal enhancement follows the sulci. The report names the recent puncture as a likely explanation. Repeat imaging can confirm resolution.
Principle: Recent lumbar puncture can cause smooth dural enhancement.

B13.10 Answer A
Lymphoma can also reach the brain from systemic disease. Secondary involvement more often affects the leptomeninges, dura, and cranial nerves than the parenchyma, and its imaging overlaps with leptomeningeal metastasis from solid tumors. Primary central nervous system lymphoma forms parenchymal masses in the periventricular white matter. The other options do not explain nerve and dural enhancement with systemic relapse. Cytology can confirm it.
Principle: Secondary CNS lymphoma favors meninges, dura, and cranial nerves.

Chapter 14: Treatment Response and Treatment Effects

B14.1 Answer E
Under RANO, the longest diameter of each enhancing lesion is multiplied by the longest perpendicular diameter, measurable lesions are at least 10 mm in both dimensions on two or more slices, and the products are summed. Cysts and resection cavities are not measured unless a nodular component meets the size threshold. An 8 mm nodule is therefore nonmeasurable and is followed as nonmeasurable disease rather than added to the sum.
Principle: Cavities are measured only when a nodular component meets the size threshold.

B14.2 Answer C
Consistency drives the value of follow-up imaging. Studies are compared with the immediately prior examination and with the baseline or best response, using the same field strength, the same sequences, and slices in the same orientation. Measuring on a different sequence or plane from one study to the next produces apparent change that reflects technique rather than tumor, so the report notes the difference and recommends a matched study.
Principle: Unmatched technique can create apparent tumor change.

B14.3 Answer B
Corticosteroids reduce edema and enhancement by restoring the blood-brain barrier, so a decrease in enhancement after a steroid increase is not a tumor response, and a reduction in dose can unmask enhancement that was suppressed. The report records whether the patient is taking corticosteroids or antiangiogenic agents when that information is available and frames any change in that light. RANO criteria likewise incorporate steroid use.
Principle: Enhancement falls with steroids; do not call it response.

B14.4 Answer D
For IDH wild-type glioblastoma, nonenhancing disease is no longer evaluated under RANO 2.0 except when assessing response to antiangiogenic agents. Increasing T2 and FLAIR signal remains reportable in clinical practice, especially when it shows mass effect or infiltration across the corpus callosum, because it can be the first sign of growth. The report describes it with its extent so the neuro-oncologist can weigh it.
Principle: Report growing FLAIR signal with mass effect even if not a RANO criterion.

B14.5 Answer A
Risk of radiation necrosis depends on dose, treated volume, and history. Reported risk factors include tumor volume, prescribed dose, fraction size, the volume of normal brain irradiated, previous radiation, and concurrent systemic therapy. Retreatment of the same lesion with radiosurgery carries a particularly high risk, so a lesion that enlarges after two courses is approached with that history in mind, and perfusion or PET is used before calling progression.
Principle: Repeat radiosurgery to one lesion raises the risk of necrosis.

B14.6 Answer D
Conventional sequences contribute some clues. A lesion with a T2-hypointense margin that matches the enhancing area closely favors necrosis, while a T2 signal that is ill defined and extends beyond the enhancement favors tumor. Restricted diffusion in solid enhancing components favors tumor, although hemorrhage and coagulative necrosis can also restrict, so no single conventional sign is decisive and perfusion or PET is often added.
Principle: A T2-dark margin matching enhancement favors radiation necrosis.

B14.7 Answer B
Spectroscopy adds metabolic information: recurrent tumor shows elevated choline with reduced N-acetylaspartate, while necrosis shows reduced metabolites with lipid and lactate. Voxel placement near bone, air, or resection cavities degrades spectra, and mixed lesions of tumor and necrosis produce intermediate patterns. Repositioning the voxel or using multivoxel spectroscopy away from these interfaces improves quality. The report notes when a spectrum is nondiagnostic.
Principle: Voxels near bone, air, or cavities give poor spectra.

B14.8 Answer A
Amino acid PET is the most validated molecular technique in this setting, and guidance emphasizes its superiority over glucose PET. Amino acid uptake is low in normal brain, so recurrent glioma stands out against a quiet background, whereas FDG uptake in normal cortex obscures small foci next to the cortex. Perfusion and diffusion imaging measure different properties and complement rather than replace PET.
Principle: Low background brain uptake makes amino acid PET clearer than FDG.

B14.9 Answer C
Combined radiosurgery and immunotherapy appears to increase radiation necrosis, and targeted agents add their own treatment effects. Reports describe enlarging treated lesions in terms of timing, perfusion, and systemic response, and avoid the word progression until the pattern is established. Lesions that shrink while others grow are reported separately, because mixed response may lead to local treatment of the growing lesion rather than a change in systemic therapy.
Principle: Report mixed responses lesion by lesion.

B14.10 Answer E
Most pseudoprogression appears within the first 12 weeks after radiotherapy, and tumors with MGMT promoter methylation show the effect more often, a combination that makes an early increase in enhancement in a methylated tumor more likely to be treatment effect. Treatment continues, and confirmation of progression requires repeat MRI or histopathology during this window. The other features do not raise the likelihood in the same way.
Principle: MGMT methylation makes early post-treatment enhancement more likely pseudoprogression.

Chapter 15: Sellar, Parasellar, and Pineal Region Masses

B15.1 Answer B
Normal pituitary anatomy varies with age and physiology. The gland is taller in adolescents and in pregnancy and the postpartum period, when an upward convex margin and a height above 10 mm can be normal. A 9 mm gland with a convex margin and homogeneous enhancement in an adolescent without symptoms is therefore a normal finding, and labeling it as an adenoma or hypophysitis would lead to unnecessary investigation.
Principle: A tall, convex pituitary can be normal in adolescents and pregnancy.

B15.2 Answer E
The posterior pituitary bright spot reflects stored vasopressin and is absent in some normal individuals, but its absence together with a thickened stalk suggests a disorder of the hypothalamus or infundibulum. With new polyuria, diabetes insipidus is likely, and the differential includes hypophysitis, sarcoidosis, histiocytosis, germinoma, metastasis, and lymphoma. The stalk should taper smoothly toward the gland and lie close to the midline.
Principle: Absent bright spot with a thick stalk suggests an infundibular disorder.

B15.3 Answer C
Macroadenomas expand the sella, extend upward through the diaphragma sellae with a waist that produces a snowman shape, and displace or compress the chiasm. They usually enhance less than the normal gland, may contain cysts or hemorrhage, and rarely calcify, a feature that favors craniopharyngioma or meningioma. Calcification in a sellar mass therefore prompts consideration of these alternatives before a confident adenoma diagnosis.
Principle: Calcification in a sellar mass favors craniopharyngioma or meningioma over adenoma.

B15.4 Answer D
An Endocrine Society guideline recommends that every patient with a pituitary incidentaloma have a history and physical examination, laboratory screening for hormone hypersecretion and hypopituitarism, and visual field testing if the lesion abuts the optic nerves or chiasm. Dedicated pituitary MRI characterizes the lesion, but blood tests are needed to detect functioning tumors and deficiency. Biopsy, sampling, and radiotherapy are not routine.
Principle: Screen every pituitary incidentaloma for hypersecretion and hypopituitarism.

B15.5 Answer A
Follow-up of pituitary incidentalomas depends on size. Pooled data showed enlargement in 24% of macroincidentalomas and 10.6% of microincidentalomas during follow-up, which is why the guideline recommends MRI at 6 months for macroincidentalomas and at 1 year for microincidentalomas, then progressively less often if unchanged. Most microincidentalomas therefore remain stable, but follow-up is not abandoned. Counseling can therefore be reassuring while still explaining the purpose of surveillance imaging.
Principle: Microincidentalomas grow less often than macroincidentalomas.

B15.6 Answer C
Prolactinomas are managed medically in most patients, and imaging documents shrinkage during treatment. Cystic change or hemorrhage within a treated prolactinoma is common and is not by itself a sign of failure. Treatment response is judged by prolactin levels and size together. Urgent surgery is reserved for apoplexy with visual compromise or for resistance, and malignant change is rare. Reporting the change neutrally avoids alarm.
Principle: Cystic change or hemorrhage in a treated prolactinoma is not failure by itself.

B15.7 Answer D
A large nonfunctioning mass with modestly raised prolactin raises a specific trap. Stalk compression raises prolactin modestly, so a large mass with mildly elevated prolactin is usually a nonfunctioning adenoma or another sellar mass. Very large prolactinomas can also be misread by laboratory assays that saturate at high concentrations, and a mismatch between tumor size and prolactin level is worth mentioning, because dilution testing can reveal a true prolactinoma treatable with medication.
Principle: Flag a size-prolactin mismatch; assays can saturate in giant prolactinomas.

B15.8 Answer B
Craniopharyngiomas have two subtypes that differ in origin and age. Adamantinomatous craniopharyngiomas have a bimodal incidence, are driven by CTNNB1 mutations, and are predominantly cystic and calcified, whereas papillary craniopharyngiomas occur in adults, often carry BRAF V600E mutations, and are typically solid. Papillary tumors are often within the third ventricle. Rathke cleft cysts and germinomas have different features. The mutation also offers a target for therapy.
Principle: Solid adult craniopharyngioma with BRAF V600E is the papillary type.

B15.9 Answer A
Stalk thickening alone has its own differential. In adults it includes hypophysitis, sarcoidosis, granulomatosis with polyangiitis, metastasis, and lymphoma, while in children Langerhans cell histiocytosis and germinoma are prominent. The report notes the thickness, the presence or absence of the bright spot, and any associated lesions in the hypothalamus, bones, or lungs that point to a systemic disease and to a site for biopsy.
Principle: Adult stalk thickening: hypophysitis, sarcoidosis, GPA, metastasis, lymphoma.

B15.10 Answer E

Pineal region masses compress the aqueduct and cause obstructive hydrocephalus, and the report states its presence and severity, because it often needs treatment before the mass itself, through endoscopic third ventriculostomy or a shunt, which can also provide tissue or cerebrospinal fluid for markers. Pineal calcification patterns help characterize the tumor but do not determine urgency, and the other features are irrelevant.

Principle: Report hydrocephalus severity with any pineal region mass.

Chapter 16: Intracranial Infection

B16.1 Answer D

Meningitis appears on MRI as leptomeningeal enhancement along the sulci and basal cisterns, best seen on postcontrast FLAIR, sometimes with purulent material that restricts diffusion in the sulci or dependent occipital horns. Ventriculitis produces ependymal enhancement and layering debris with restricted diffusion. It is a serious complication associated with poor outcome, and recognizing it can change the antibiotic route and duration and prompt drainage.

Principle: Ependymal enhancement with restricting intraventricular debris indicates ventriculitis.

B16.2 Answer E

Complications drive imaging in established meningitis, and they include hydrocephalus, subdural effusions and empyemas, cerebritis and abscess, ventriculitis, arterial vasculitis with infarcts, and venous sinus thrombosis. Infarcts in the basal ganglia and thalami reflect involvement of perforating arteries crossing the inflamed basal cisterns. Recognizing this mechanism explains new deficits during treatment and prompts vessel imaging when larger arteries may also be affected.

Principle: Deep gray infarcts in meningitis come from inflamed perforating arteries.

B16.3 Answer B

Sources outside the meninges are part of the same search, and the mastoids and sinuses are reviewed on every study of a patient with meningitis. Opacified mastoid air cells with bone erosion, or a frontal sinus with a breached posterior wall, identify a source that may need surgery. Mucosal thickening, retention cysts, and anatomical variants are common incidental findings and do not by themselves explain intracranial infection.

Principle: Seek bone breach of the sinus or mastoid as a surgical source.

B16.4 Answer C

Diffusion is the key observation, because central restriction with a smooth rim distinguishes abscess from necrotic tumor in most cases, whereas tumor necrosis usually shows facilitated diffusion. Perfusion in the capsule is low. Spectroscopy of the cavity can show amino acids, acetate, and succinate, which reflect bacterial metabolism and are not expected in tumor necrosis. Elevated choline instead suggests a cellular neoplasm.

Principle: Amino acids, acetate, and succinate on spectroscopy suggest abscess.

B16.5 Answer A

Multiplicity changes the likely source of brain abscess. Several small abscesses at the gray-white junction suggest hematogenous spread from endocarditis or from a right-to-left shunt, so the report recommends echocardiography or a search for a pulmonary arteriovenous malformation. A single abscess next to an opacified sinus or mastoid instead points to contiguous spread from that site, which directs the search toward surgical drainage of the source.

Principle: Multiple junctional abscesses prompt a search for an embolic source.

B16.6 Answer B
Herpes simplex encephalitis is the most important sporadic cause of encephalitis in adults and is treatable. It involves the medial temporal lobes, insular cortex, and inferior frontal lobes, usually asymmetrically, and spares the basal ganglia, which separates it from middle cerebral artery infarction, where the lenticulostriate territory is often involved. Diffusion restriction and swelling occur in both conditions and do not discriminate.
Principle: HSV encephalitis spares the basal ganglia, unlike MCA infarction.

B16.7 Answer A
Different viruses produce characteristic distributions on MRI. Varicella zoster virus causes vasculopathy with infarcts and vessel wall enhancement, Japanese encephalitis and West Nile virus involve the thalami, basal ganglia, and brainstem, and enterovirus 71 affects the dorsal brainstem and dentate nuclei. Herpes simplex involves the limbic system. Travel history combined with thalamic involvement makes a flavivirus the leading consideration. Serology confirms it.
Principle: Thalamic and basal ganglia involvement suggests flavivirus encephalitis.

B16.8 Answer E
Fungal infections vary by organism and host. Cryptococcus spreads along perivascular spaces into the basal ganglia, producing dilated gelatinous pseudocysts in immunocompromised patients. Aspergillus and Mucorales invade blood vessels and cause hemorrhagic infarcts, and mucormycosis characteristically extends directly from the sinuses into the orbit and brain. Diabetic ketoacidosis is a classic risk factor for mucormycosis, which requires urgent surgical and antifungal treatment.
Principle: Angioinvasive Mucorales spread from sinuses and cause hemorrhagic infarcts.

B16.9 Answer C
Neurocysticercosis cysts evolve through recognizable stages. A viable cyst contains fluid with a mural scolex, the colloidal stage has a thickened enhancing wall and surrounding edema as the parasite dies, and the end stage is a calcified nodule that can still provoke seizures. Perilesional edema around a calcification is recognized during seizure recurrence, so a calcified lesion is not automatically inert.
Principle: Calcified neurocysticercosis is the end stage and can still cause seizures.

B16.10 Answer D
Postoperative infection is a separate diagnostic problem. After craniotomy, enhancement of the bone flap margins, dura, and resection cavity is expected for months, so infection is suggested instead by a rim-enhancing collection with restricted diffusion, bone flap erosion, or new ventricular debris. Comparison with the early postoperative study helps separate expected change from complication, and isolated enhancement without these features is not evidence of infection.
Principle: Dural and flap enhancement is expected for months after craniotomy.

Chapter 17: Multiple Sclerosis

B17.1 Answer C
A neutral report avoids labeling nonspecific white matter foci as demyelination. A description of a few small punctate deep white matter lesions without typical features, in a patient over 50 with vascular risk factors, is usually more useful than a list of possible causes that begins with multiple sclerosis. Misdiagnosis is a real problem, and inappropriate image interpretation contributes to it.
Principle: Describe nonspecific white matter foci neutrally in older vascular patients.

B17.2 Answer A
Juxtacortical lesions abut the cortex and typically involve the U fibers, which are generally spared by hypoxia and cerebrovascular disease because they have a dual blood supply. Lesions touching the cortex therefore favor demyelination. Cortical lesions are difficult to see on conventional sequences, and current practice groups intracortical, leukocortical, and juxtacortical lesions together as a single cortical or juxtacortical location in the diagnostic criteria.
Principle: Dual supply spares U fibers in vascular disease, favoring MS when involved.

B17.3 Answer D
Spinal cord lesions in multiple sclerosis are often multiple and short, covering less than two vertebral segments and usually less than half of the cord area. They should be focal with a clearly defined border, cigar shaped on sagittal images, wedge shaped on axial images, and visible on at least two sequences or in two planes. Central or extensive lesions suggest other disorders.
Principle: Typical MS cord lesions are short, peripheral, and wedge shaped axially.

B17.4 Answer B
Enhancement marks recent inflammation and in new demyelinating lesions is usually short lived, typically 2 to 8 weeks and most often under 4 weeks. It is often nodular or an incomplete ring open toward the cortex, and the open ring helps separate a large demyelinating lesion from tumor or abscess, which more often show a complete ring. Recognizing it can avoid unnecessary surgery.
Principle: An incomplete ring open toward cortex favors tumefactive demyelination.

B17.5 Answer E
Enhancement marks recent inflammation. In new demyelinating lesions it is usually short lived, typically 2 to 8 weeks and most often under 4 weeks, which generally separates recent from older lesions. An enhancing lesion therefore indicates activity within roughly the previous two months and supports dissemination in time when nonenhancing lesions are also present, whereas persistent enhancement for many months suggests another diagnosis.
Principle: Demyelinating lesion enhancement typically lasts under 4 weeks.

B17.6 Answer D
Paramagnetic rim lesions are a marker of chronic active inflammation. In 209 patients, 56% had at least one rim lesion regardless of treatment, and patients with four or more rim lesions reached motor and cognitive disability at an earlier age. Rim lesions were stable or expanded over time while rimless lesions shrank. They are therefore a prognostic marker that conventional imaging does not capture.
Principle: Four or more paramagnetic rim lesions predict earlier disability.

B17.7 Answer E
Monitoring compares a new study with a recent baseline on the same scanner where possible, with identical sequences and orientation. New or enlarging T2 lesions are the main measure of disease activity during treatment, and side-by-side or subtraction review of three-dimensional FLAIR images increases their detection. Reports list the number of new or enlarging lesions explicitly. Atrophy remains mainly a research and trial measure.
Principle: New or enlarging T2 lesions are the main treatment monitoring measure.

B17.8 Answer C
Brain atrophy reflects neurodegeneration that lesions alone do not capture, and it progresses faster in multiple sclerosis than in healthy aging. Measurement in individual patients is affected by hydration, corticosteroids, and early treatment effects, so it remains mainly a research and trial measure. A visual comment on unexpected atrophy is still reasonable, but precise serial volumes are not yet reliable for individual management decisions.
Principle: Individual atrophy measures are confounded by hydration and treatment.

B17.9 Answer B
Treatment can now change the course of radiologically isolated syndrome. In a randomized trial of 87 people, dimethyl fumarate greatly reduced the risk of a first clinical demyelinating event during 96 weeks compared with placebo. The finding makes a precise description of incidental typical lesions more consequential than it was, because a correct label can now lead to treatment rather than simple observation.
Principle: Treating radiologically isolated syndrome can delay a first clinical event.

B17.10 Answer A
Several features argue against multiple sclerosis. Lesions that spare the U fibers, symmetric confluent changes, lacunes and microbleeds, a longitudinally extensive cord lesion, and rounded central corpus callosum lesions of Susac syndrome are red flags. Susac syndrome combines encephalopathy, hearing loss, and branch retinal artery occlusions, and its central callosal lesions differ from the lesions of multiple sclerosis along the callosal undersurface.
Principle: Central rounded callosal lesions suggest Susac syndrome over MS.

Chapter 18: NMOSD, MOGAD, and Autoimmune Encephalitis

B18.1 Answer D
The longitudinally extensive transverse myelitis lesion is the signature finding of neuromyelitis optica spectrum disorder. It spans three or more contiguous vertebral segments, has a predilection for the central cord, and in the cervical region may extend into the medulla, a characteristic pattern of the disorder. Multiple sclerosis lesions are typically short and peripheral, covering fewer than two segments. Antibody testing confirms it.
Principle: A long central cord lesion extending into the medulla suggests NMOSD.

B18.2 Answer A
Optic neuritis in neuromyelitis optica tends to be longer and more posterior than in multiple sclerosis, often involving the chiasm and sometimes both nerves. Correct identification matters because early immunosuppression prevents attack-related disability, whereas some disease-modifying drugs for multiple sclerosis may make the disease worse. Anterior optic neuritis with disc swelling and perineural enhancement instead suggests MOG antibody disease. Location therefore guides testing.
Principle: Long posterior optic neuritis involving the chiasm suggests NMOSD.

B18.3 Answer C
Several imaging features suggest MOG antibody-associated disease. Optic neuritis is often bilateral and anterior, with swelling of the optic disc and enhancement of the optic nerve sheath and surrounding fat. Spinal cord lesions may be longitudinally extensive or short and multiple and frequently involve the conus medullaris. Recognizing the pattern directs antibody testing and influences treatment and follow-up decisions. Serum testing confirms it.
Principle: Bilateral anterior optic neuritis with perineural enhancement suggests MOGAD.

B18.4 Answer B
In MOG antibody-associated disease, spinal cord lesions may be longitudinally extensive or short and multiple and frequently involve the conus medullaris. Brain lesions are usually fluffy and poorly marginated in the deep gray matter, brainstem, and cerebellar peduncles, and they tend to resolve more completely than multiple sclerosis lesions. Conus involvement is less typical of aquaporin-4 disease and of multiple sclerosis.
Principle: Conus involvement with fluffy brain lesions suggests MOGAD.

B18.5 Answer E
In acute disseminated encephalomyelitis, lesions are large, multiple, bilateral, and asymmetric, with poorly defined margins, in the white matter, deep gray matter, brainstem, and cord. They tend to be of similar age, so enhancement is either absent or present in many lesions together, unlike the mixture of enhancing and nonenhancing lesions seen in multiple sclerosis, which reflects dissemination in time.
Principle: Uniform enhancement in ADEM reflects lesions of similar age.

B18.6 Answer D
Follow-up imaging separates a single episode from a chronic disease. Lesions of acute disseminated encephalomyelitis should improve or resolve over months, and new lesions after the first 3 months suggest an alternative diagnosis, including multiple sclerosis or a relapsing antibody-mediated disorder. Many children with acute disseminated encephalomyelitis have MOG antibodies, and testing helps establish the risk of further attacks. Repeat imaging is therefore planned.
Principle: New lesions after 3 months suggest a diagnosis other than monophasic ADEM.

B18.7 Answer B
The main differential of medial temporal signal is herpes simplex encephalitis, followed by seizure-related change, gliomatosis, and infarction. Autoimmune limbic encephalitis is usually more symmetric, does not restrict diffusion as strongly, spares the insula more often, and lacks hemorrhage. Because the two diseases can coexist, and herpes encephalitis can trigger autoimmune encephalitis, antiviral treatment and cerebrospinal fluid testing are not delayed.
Principle: Symmetric limbic signal sparing the insula favors autoimmune encephalitis.

B18.8 Answer A
Antibodies to LGI1 cause limbic encephalitis with faciobrachial dystonic seizures and sometimes T1 and T2 hyperintensity of the basal ganglia, and hyponatremia is common. Antibodies to GAD65 cause limbic encephalitis with refractory seizures and are associated with stiff-person syndrome. The faciobrachial seizures are a key clinical clue, and early immunotherapy can prevent progression to cognitive impairment. Imaging of the basal ganglia may add support.
Principle: Faciobrachial dystonic seizures with hyponatremia suggest LGI1 encephalitis.

B18.9 Answer E
Neurosarcoidosis produces varied imaging patterns. Nodular or smooth leptomeningeal enhancement favors the basal cisterns, hypothalamus, infundibulum, and optic chiasm, and dural thickening can mimic meningioma. Parenchymal lesions spread along perivascular spaces, and cranial nerve enhancement, especially of the facial and optic nerves, is common. Systemic imaging for a biopsy site often provides the tissue that the brain lesion cannot. Chest CT is therefore helpful.
Principle: Basal leptomeningeal enhancement with cranial nerve involvement suggests sarcoidosis.

B18.10 Answer C

A normal MRI in a patient with suspected encephalitis is still a useful report. It lowers the probability of herpes infection and structural causes, keeps antibody-mediated disease in the differential, and supports the case for cerebrospinal fluid and antibody testing. Anti-NMDA receptor encephalitis in particular often has a normal or nearly normal MRI despite severe illness, so a normal study never closes the investigation.
Principle: A normal MRI does not exclude autoimmune encephalitis.

Chapter 19: Dementia and Neurodegenerative Disease

B19.1 Answer B

Visual rating scales make atrophy reportable. The Fazekas scale grades white matter hyperintensities and the global cortical atrophy scale grades sulcal widening, while the Koedam scale grades posterior atrophy in the precuneus and parietal lobes. That scale is useful in early-onset Alzheimer disease, where the hippocampi may be relatively preserved, so a normal medial temporal score does not exclude the disease in younger patients.
Principle: Use the Koedam scale for posterior atrophy in early-onset Alzheimer disease.

B19.2 Answer A

Atypical presentations of Alzheimer disease have their own patterns. Posterior cortical atrophy affects the occipital and parietal lobes and presents with visual processing deficits, the logopenic variant of primary progressive aphasia affects the left temporoparietal junction, and frontal variants affect the frontal lobes. Recognizing these patterns prevents a normal hippocampal appearance from being taken as evidence against Alzheimer pathology, and biomarkers can confirm it.
Principle: Occipitoparietal atrophy with visual deficits suggests posterior cortical atrophy.

B19.3 Answer C

Vascular findings are always reported in cognitive impairment. Confluent white matter hyperintensities, lacunes, strategic infarcts, and microbleeds contribute to cognitive decline and often coexist with Alzheimer disease. Lobar microbleeds and cortical superficial siderosis suggest cerebral amyloid angiopathy, which has direct consequences for treatment, including eligibility for anti-amyloid antibodies and decisions about anticoagulation, because the risk of hemorrhage is increased. The report names it directly.
Principle: Lobar microbleeds with superficial siderosis suggest cerebral amyloid angiopathy.

B19.4 Answer E

Amyloid-related imaging abnormalities come in two forms. ARIA-E is vasogenic edema or sulcal effusion, seen as FLAIR hyperintensity in the cortex and subcortical white matter or in the sulci, and ARIA-H is hemosiderin deposition, seen as new microbleeds or superficial siderosis. Most cases are asymptomatic and are detected only on surveillance MRI, which is why scheduled scanning is part of treatment.
Principle: New microbleeds or siderosis during anti-amyloid therapy are ARIA-H.

B19.5 Answer D

Appropriate use recommendations for lecanemab address patient selection and monitoring. Patients with more than four microhemorrhages or other evidence of cerebrovascular disease are excluded, which is thought to reduce the risk of ARIA. MRI is recommended at baseline and before the fifth, seventh, and fourteenth infusions, and additional imaging is obtained when symptoms suggest ARIA. Most ARIA occurs early in treatment.
Principle: Lecanemab surveillance MRI: before infusions 5, 7, and 14.

B19.6 Answer D
Genetics strongly modifies the risk of amyloid-related imaging abnormalities, with ARIA rising with APOE ε4 dose, and genotyping is recommended before lecanemab is started. Patients requiring anticoagulants should not receive lecanemab, because of the risk of hemorrhage during therapy. The baseline MRI and medication history together determine whether treatment can proceed safely. Thrombolytic therapy for ischemic stroke should also not be given to patients receiving lecanemab.
Principle: Patients who need anticoagulants should not receive lecanemab.

B19.7 Answer B
ARIA has mimics that the report considers. Posterior reversible encephalopathy, infection, seizure-related cortical signal, and inflammatory cerebral amyloid angiopathy can all produce cortical and subcortical FLAIR signal, and a new infarct restricts diffusion where ARIA-E usually does not. Comparison with the baseline and previous surveillance studies helps establish that the abnormality is new and fits the expected pattern. Diffusion imaging is therefore essential.
Principle: Restricted diffusion favors infarct over ARIA-E.

B19.8 Answer E
Primary progressive aphasia is divided into nonfluent or agrammatic, semantic, and logopenic variants, and a diagnosis can be specified as imaging supported when the expected atrophy pattern is found. The nonfluent variant affects the left posterior frontal and insular cortex, the semantic variant affects the anterior temporal lobes, and the logopenic variant affects the left temporoparietal junction, where Alzheimer pathology is common.
Principle: Nonfluent PPA: left posterior frontal and insular atrophy.

B19.9 Answer A
Functional imaging adds two characteristic findings in dementia with Lewy bodies. Reduced dopamine transporter uptake in the basal ganglia on SPECT is an indicative biomarker, and FDG PET can show occipital hypometabolism with relative preservation of the posterior cingulate, the cingulate island sign. Alzheimer disease instead shows posterior cingulate hypometabolism, so preserved cingulate metabolism with occipital hypometabolism points toward Lewy body disease.
Principle: The cingulate island sign on FDG PET suggests dementia with Lewy bodies.

B19.10 Answer C
Parkinson disease itself has a largely normal conventional MRI. Loss of the normal dorsolateral nigral hyperintensity on susceptibility-weighted imaging at 3 T, the swallow tail sign, and neuromelanin-sensitive imaging of the substantia nigra are promising markers, and dopamine transporter SPECT separates degenerative parkinsonism from conditions without nigrostriatal loss such as essential tremor and drug-induced parkinsonism. It complements dopamine transporter imaging.
Principle: Loss of the swallow tail sign suggests degenerative parkinsonism.

Chapter 20: Toxic and Metabolic Encephalopathies

B20.1 Answer D
The characteristic finding of posterior reversible encephalopathy syndrome is bilateral subcortical vasogenic edema that resolves within days or weeks. The parietal and occipital lobes are most often affected, and three patterns are described: a dominant parieto-occipital pattern, a holohemispheric watershed pattern along the border zones, and a superior frontal sulcus pattern. Recognizing all three prevents the diagnosis from being missed when the occipital lobes are relatively spared.
Principle: PRES has parieto-occipital, holohemispheric watershed, and superior frontal sulcus patterns.

B20.2 Answer A
Most patients with posterior reversible encephalopathy syndrome recover, and the syndrome usually resolves spontaneously with clinical and radiological improvement. Severe forms can cause substantial morbidity and death, most often from acute hemorrhage or massive posterior fossa edema causing obstructive hydrocephalus or brainstem compression. The report therefore states the size of the fourth ventricle and the state of the cisterns whenever the cerebellum is involved.
Principle: Posterior fossa edema in PRES can cause hydrocephalus and brainstem compression.

B20.3 Answer B
MRI of Wernicke encephalopathy shows symmetric T2 and FLAIR hyperintensity in the medial thalami, mammillary bodies, periaqueductal gray matter, tectal plate, and the floor of the fourth ventricle. Diffusion may be restricted in the acute phase, and enhancement of the mammillary bodies is a useful sign, particularly in alcohol-related disease. Nonalcoholic patients more often have atypical involvement of the cortex and cranial nerve nuclei.
Principle: Mammillary body enhancement supports alcohol-related Wernicke encephalopathy.

B20.4 Answer E
Several conditions mimic the Wernicke pattern. Deep cerebral venous thrombosis causes bilateral thalamic edema but spares the mammillary bodies and shows an occluded internal cerebral vein or straight sinus. Artery of Percheron infarction produces paramedian thalamic and sometimes rostral midbrain restriction with an abrupt onset. Reviewing the deep veins and the mammillary bodies on every study with bilateral thalamic signal separates these causes.
Principle: Bilateral thalamic edema with an occluded deep vein suggests venous thrombosis.

B20.5 Answer C
Imaging changes of osmotic demyelination lag behind the symptoms. The pons shows symmetric central T2 hyperintensity sparing the ventrolateral pons and the corticospinal tracts at its periphery, a trident or bat-wing shape on axial images. Extrapontine lesions involve the basal ganglia, thalami, external capsules, and cerebellar white matter symmetrically. An early normal MRI therefore does not exclude the diagnosis in a typical clinical course.
Principle: Osmotic demyelination spares the ventrolateral pons and corticospinal tracts.

B20.6 Answer D
Adult hypoxic-ischemic injury after cardiac arrest is a common problem in the intensive care unit. Diffusion restriction appears first in the basal ganglia, thalami, and cerebellum within the first day, then in the cortex, and may be subtle because the injury is symmetric. Extensive cortical restriction and loss of gray-white differentiation indicate severe injury, and comparison with normal structures such as the white matter helps detect symmetric change.
Principle: Hypoxic injury restricts first in the basal ganglia, thalami, and cerebellum.

B20.7 Answer B
Several toxins have recognizable targets. Carbon monoxide poisoning affects the globi pallidi and can cause a delayed leukoencephalopathy weeks after apparent recovery. Methanol damages the putamina, often with hemorrhage, and the subcortical white matter. Cyanide and other mitochondrial poisons affect the basal ganglia and cortex. Putaminal necrosis with hemorrhage, visual loss, and acidosis together therefore make methanol poisoning the leading consideration.
Principle: Methanol causes hemorrhagic putaminal necrosis.

B20.8 Answer C
Drug-related leukoencephalopathies have recognizable patterns. Toxic leukoencephalopathy from inhaled heroin spares the subcortical U fibers and favors the posterior cerebral and cerebellar white matter, and methotrexate leukoencephalopathy can cause acute restricted diffusion in the centrum semiovale. A history of inhalation, sometimes called chasing the dragon, is the key clinical link, and symmetric posterior and cerebellar involvement strongly suggests it. Stopping exposure is essential.
Principle: Inhaled heroin leukoencephalopathy spares U fibers and favors posterior white matter.

B20.9 Answer A
Inherited and acquired metabolic diseases complete the differential of symmetric deep gray matter change. Wilson disease affects the putamina, thalami, and brainstem, with a face of the giant panda sign in the midbrain, while Creutzfeldt-Jakob disease restricts diffusion in the caudate, putamen, cortex, or pulvinar. A young patient with movement disorder and liver disease makes Wilson disease the leading diagnosis, confirmed by copper studies.
Principle: The giant panda sign with deep gray involvement suggests Wilson disease.

B20.10 Answer E
Creutzfeldt-Jakob disease restricts diffusion in the caudate, putamen, cortex, or pulvinar, and diffusion-weighted imaging is the most sensitive sequence for these changes. Combined with rapidly progressive dementia and myoclonus, cortical ribbon and striatal restriction makes prion disease the leading diagnosis. The report names it explicitly so that infection control and cerebrospinal fluid testing for prion markers can proceed. Biopsy is rarely needed.
Principle: Cortical ribbon and striatal restriction suggest Creutzfeldt-Jakob disease.

Chapter 21: Hydrocephalus and CSF Pressure Disorders

B21.1 Answer A
Acute obstruction produces transependymal flow of fluid into the periventricular white matter, seen as smooth FLAIR hyperintensity capping the frontal and occipital horns. It indicates that ventricular pressure is raised and that hydrocephalus is active rather than compensated. The finding is reported with the level of obstruction, because it supports urgent diversion of cerebrospinal fluid. Ependymal tumor spread would instead show nodular enhancement.
Principle: Smooth periventricular FLAIR capping in obstruction is transependymal flow.

B21.2 Answer B
The Evans index, the ratio of the maximal width of the frontal horns to the maximal inner width of the skull, is a simple measure of ventricular size, with values above 0.3 indicating ventricular enlargement. It does not distinguish hydrocephalus from atrophy by itself, so it is interpreted with the shape of the ventricles, the temporal horns, the callosal angle, and the sulci, which together separate the two processes.
Principle: An Evans index above 0.3 indicates ventricular enlargement.

B21.3 Answer C
Shunt malfunction is a frequent emergency. Comparison with prior studies is essential, because some patients have chronically large ventricles and a small change may be significant, while others with slit ventricles develop raised pressure without enlargement. A shunt series of radiographs checks the continuity of the catheter. Unchanged small ventricles therefore do not exclude malfunction in a symptomatic patient, and clinical assessment continues.
Principle: Slit ventricles can have raised pressure without enlarging.

B21.4 Answer D
Hydrocephalus affects the posterior fossa and the brain at large in ways worth naming. Downward herniation of the third ventricle into the sella, a dilated suprapineal recess compressing the tectum with upgaze palsy, and thinning of the corpus callosum all indicate long-standing pressure. These secondary changes help date the process and explain symptoms, such as upgaze palsy, that might otherwise be attributed to a separate lesion.
Principle: Third ventricular herniation and suprapineal recess dilation indicate chronic hydrocephalus.

B21.5 Answer E
Imaging does not settle the diagnosis of idiopathic normal pressure hydrocephalus alone. A cerebrospinal fluid tap test is useful for diagnosis and for predicting the effect of a shunt, with a reported sensitivity of 58% and specificity of 75%, and patients may improve after shunting even if they did not respond to the tap test. A negative tap test therefore does not remove shunting from consideration when imaging is typical.
Principle: A negative tap test does not exclude shunt-responsive NPH.

B21.6 Answer E
Disproportionately enlarged subarachnoid-space hydrocephalus is an important imaging feature of idiopathic normal pressure hydrocephalus, but it is not universal. Among patients diagnosed with the disease, DESH findings were present in 64%, so their absence does not exclude it. The diagnosis then rests on the clinical triad, ventricular enlargement, other supportive imaging features, and cerebrospinal fluid testing, including the tap test.
Principle: Absence of DESH does not exclude idiopathic NPH.

B21.7 Answer A
Transverse sinus stenosis deserves a specific comment in idiopathic intracranial hypertension. Venography often shows anatomical abnormalities of the venous sinuses, including stenosis of the dominant or both transverse sinuses. Whether stenosis is a cause or a consequence of raised pressure is debated, but it identifies patients who may be candidates for venous sinus stenting when vision is threatened and other treatments fail.
Principle: Transverse sinus stenosis in IIH identifies possible stenting candidates.

B21.8 Answer D
A UK multidisciplinary consensus guideline recommends that spontaneous intracranial hypotension be considered in any patient with orthostatic headache and that first-line imaging be MRI of the brain with contrast and of the whole spine. The brain study shows the signs of low pressure, and the spine study looks for a spinal longitudinal epidural collection, which determines the choice of later myelographic technique if a leak must be localized.
Principle: First-line imaging for suspected SIH is contrast brain MRI plus whole spine MRI.

B21.9 Answer C
Sagging of the brain has its own signs. The cerebellar tonsils descend, mimicking a Chiari malformation, the pons flattens against the clivus, the midbrain descends with a reduced angle between the midbrain and pons, and the optic chiasm drapes over the sella. Recognizing intracranial hypotension prevents an unnecessary decompression and directs treatment toward finding and sealing the leak. Contrast-enhanced images help confirm it.
Principle: Tonsillar descent with brain sagging suggests intracranial hypotension, not Chiari.

B21.10 Answer B

Cerebrospinal fluid-venous fistulas are a newer discovery, and leaked fluid is rapidly absorbed by the epidural venous plexus, so no collection forms. Fistulas are most often in the thoracic spine adjacent to nerve root sleeves, often with diverticula, and are seen as opacification of a paraspinal vein, the hyperdense paraspinal vein sign, on decubitus CT myelography. Targeted treatment includes transvenous embolization.

Principle: A hyperdense paraspinal vein on myelography indicates a CSF-venous fistula.

Chapter 22: Epilepsy Imaging

B22.1 Answer D

The risk of recurrence after a first unprovoked seizure in adults is greatest within the first 2 years, at 21% to 45%. Clinical variables associated with increased risk include a prior brain insult, an EEG with epileptiform abnormalities, a significant brain imaging abnormality, and a nocturnal seizure. A structural lesion found on MRI therefore contributes directly to the decision about starting treatment after a single seizure.

Principle: First seizure recurrence risk peaks in the first 2 years, at 21% to 45%.

B22.2 Answer B

Acute symptomatic seizures follow a different logic from epilepsy. Seizures within a week of a stroke, head injury, infection, or metabolic disturbance are provoked, and imaging aims at the acute cause, such as hemorrhage, venous thrombosis, encephalitis, or posterior reversible encephalopathy. A dedicated epilepsy protocol with thin hippocampal sections is reserved for unprovoked seizures and suspected focal epilepsy rather than for this setting.

Principle: Provoked seizures prompt imaging for the acute cause.

B22.3 Answer C

An outpatient protocol proposal identified FLAIR, T2-weighted, T1-weighted, and hemosiderin- and calcification-sensitive sequences as indispensable. Slice thickness for T2-weighted and FLAIR images should not exceed 3 mm, and the T1-weighted sequence should be three-dimensional with 1 mm isotropic voxels. Thin isotropic data allow reformatting along any plane, which helps follow a sulcus to its depth where subtle dysplasia hides. 3 T improves detection.

Principle: Epilepsy MRI: T2/FLAIR at most 3 mm; 3D T1 with 1 mm isotropic voxels.

B22.4 Answer E

The ILAE classification divides hippocampal sclerosis into three types by the pattern of neuronal loss and gliosis. Type 1 involves severe cell loss mainly in the CA1 and CA4 regions, type 2 mainly CA1, and type 3 mainly CA4. Type 1 is the most common pattern and is more often associated with an initial precipitating injury before age 5, early onset of seizures, and a favorable surgical outcome.

Principle: ILAE type 1 hippocampal sclerosis involves CA1 and CA4.

B22.5 Answer A

MRI signs of hippocampal sclerosis are volume loss of the hippocampus, increased T2 and FLAIR signal, and loss of the internal architecture of the stratum radiatum on coronal T2-weighted images. Secondary signs include enlargement of the temporal horn, atrophy of the ipsilateral fornix and mammillary body, and reduced volume or blurred gray-white differentiation of the temporal pole. These secondary signs help confirm subtle cases.

Principle: Ipsilateral fornix and mammillary body atrophy support hippocampal sclerosis.

B22.6 Answer A
Normal variants can mimic hippocampal disease. Hippocampal sulcus remnant cysts are small, round, fluid-signal cysts between the dentate gyrus and the cornu ammonis and are of no significance. Incomplete hippocampal inversion, or malrotation, gives the hippocampus a round, vertically oriented shape, more often on the left, and is common in the general population, although it is more frequent in some malformations.
Principle: Incomplete hippocampal inversion is a common variant, not a cause by itself.

B22.7 Answer B
Long-term epilepsy-associated tumors are a separate group. Gangliogliomas are cortical, often temporal, and cystic with a mural nodule, calcification, and variable enhancement. Dysembryoplastic neuroepithelial tumors are cortical, multicystic or bubbly, bright on T2 with a FLAIR-hyperintense rim, and do not enhance or cause edema. Calcification and a nodule therefore favor ganglioglioma in a young patient with a long seizure history.
Principle: A temporal cyst with calcified mural nodule in epilepsy suggests ganglioglioma.

B22.8 Answer D
Hypothalamic hamartoma is a distinctive cause of gelastic seizures, episodes of laughter without mirth, often beginning in infancy and accompanied by precocious puberty. MRI shows a nonenhancing mass attached to the tuber cinereum or mammillary bodies, isointense to gray matter on T1-weighted images and slightly hyperintense on T2-weighted images. Lack of enhancement and stability over time distinguish it from neoplasms in this region.
Principle: Gelastic seizures with a nonenhancing tuber cinereum mass indicate hypothalamic hamartoma.

B22.9 Answer E
Status epilepticus can leave permanent damage, including hippocampal swelling followed by atrophy and sclerosis. Cytotoxic lesions of the splenium of the corpus callosum, small ovoid areas of restricted diffusion, can accompany seizures and antiseizure drug changes and usually resolve. Recognizing this pattern prevents misdiagnosis as infarction or demyelination, and follow-up imaging documents resolution when the clinical picture is consistent. No treatment is needed.
Principle: Splenial cytotoxic lesions after seizures usually resolve.

B22.10 Answer C
Presurgical evaluation combines imaging with electrophysiology. Interictal FDG PET shows hypometabolism in the epileptogenic region, often larger than the lesion. Ictal SPECT, with injection during a seizure, shows hyperperfusion at the onset zone, and subtraction from an interictal study improves localization. Timing of injection matters, because late injection can show propagation rather than onset, and results are interpreted together with EEG findings.
Principle: Ictal SPECT shows hyperperfusion at onset; subtraction improves localization.

Chapter 23: Orbit and Visual Pathway

B23.1 Answer E
Trauma is a common indication for orbital imaging. Orbital floor and medial wall fractures are described with their size and any herniated fat or muscle, because entrapment of the inferior rectus, particularly in children with trapdoor fractures, needs early surgery. A small, minimally displaced fracture in a child can trap muscle more tightly than a large one, so restricted gaze with vagal symptoms is treated as urgent.
Principle: Inferior rectus entrapment in pediatric trapdoor fractures needs early surgery.

B23.2 Answer D
Retrobulbar hematoma causes proptosis and stretching of the optic nerve with a tented posterior globe and is a surgical emergency, because rising orbital pressure threatens the blood supply of the nerve and retina. Prompt lateral canthotomy and cantholysis can preserve vision. The tented posterior globe is a specific sign of severe tension, and it is communicated directly to the clinicians without delay.
Principle: Retrobulbar hematoma with globe tenting is a surgical emergency.

B23.3 Answer B
Preseptal cellulitis is confined to the eyelids and soft tissues in front of the septum and does not cause proptosis, ophthalmoplegia, or visual loss. Orbital cellulitis shows inflammatory stranding of the orbital fat behind the septum. Contrast-enhanced CT is obtained when there is proptosis, restricted or painful eye movement, reduced vision, or failure to improve with treatment, because these findings suggest postseptal spread.
Principle: Painful or restricted eye movement prompts orbital CT for postseptal infection.

B23.4 Answer A
Imaging of thyroid eye disease shows enlargement of the extraocular muscle bellies with sparing of the tendinous insertions on the globe. The inferior and medial rectus muscles are most often involved, followed by the superior and lateral recti, and involvement is usually bilateral, though often asymmetric. Increased orbital fat contributes to proptosis. Isolated lateral rectus enlargement is unusual and should prompt consideration of another cause.
Principle: Thyroid eye disease favors the inferior and medial recti, sparing tendons.

B23.5 Answer C
Idiopathic orbital inflammation can involve any orbital structure. Myositis enlarges a single muscle, including its tendon insertion, and dacryoadenitis enlarges the lacrimal gland. Inflammation can spread through the orbital apex to the cavernous sinus as Tolosa-Hunt syndrome, which causes painful ophthalmoplegia. Because lymphoma, sarcoidosis, and infection can look similar, the diagnosis is one of exclusion and follow-up imaging is required.
Principle: Apical inflammation extending to the cavernous sinus is Tolosa-Hunt syndrome.

B23.6 Answer E
Treatment evidence for optic neuritis dates to the Optic Neuritis Treatment Trial. Intravenous methylprednisolone followed by oral prednisone sped recovery of visual loss and gave slightly better vision at 6 months, while oral prednisone alone was ineffective and increased the risk of new episodes of optic neuritis. MRI at presentation also helps estimate the risk of later multiple sclerosis. Oral prednisone alone is avoided.
Principle: Oral prednisone alone for optic neuritis increased recurrence.

B23.7 Answer B
The differential of an enhancing optic nerve includes optic nerve sheath meningioma, glioma, sarcoidosis, lymphoma and leukemia, infection, and radiation injury. Ischemic optic neuropathy usually shows no enhancement, and in giant cell arteritis enhancement of the nerve sheath and orbital fat may be seen. Recognizing the pattern supports urgent corticosteroid treatment to protect the other eye, while temporal artery assessment confirms the diagnosis.
Principle: Giant cell arteritis may enhance the optic nerve sheath and orbital fat.

B23.8 Answer C
Optic nerve tumors have distinct shapes. Gliomas often cause fusiform enlargement in which the nerve cannot be separated from the lesion, while meningiomas classically have a tram-track configuration with enhancing tumor alongside the nerve. Gliomas are associated with neurofibromatosis type 1 and occur mainly in children, while meningiomas occur mainly in middle-aged adults. Age, shape, and syndrome together point to glioma here.
Principle: Fusiform optic nerve enlargement in a child with NF1 indicates glioma.

B23.9 Answer A
Choroidal melanoma is the most common primary adult ocular malignancy, and melanin shortens T1 and T2, producing T1 hyperintensity and T2 hypointensity, although amelanotic lesions lack these features. Breast cancer is the most common malignancy to metastasize to the orbit. Retinoblastoma is a calcified intraocular mass in young children, so the age and signal pattern together favor melanoma in this adult patient.
Principle: T1-bright, T2-dark intraocular mass in an adult suggests melanoma.

B23.10 Answer D
Children have their own spectrum of orbital disease. Retinoblastoma is a calcified intraocular mass in young children, best confirmed with ultrasound and evaluated with MRI for optic nerve and intracranial spread without CT radiation. Avoiding radiation matters especially in hereditary retinoblastoma, in which the risk of later second cancers is increased, so MRI is the staging study of choice. Ultrasound remains complementary.
Principle: Stage retinoblastoma with MRI rather than CT.

Chapter 24: Temporal Bone and Cerebellopontine Angle

B24.1 Answer B
Cochlear implant candidates need both examinations. CT shows the cochlear anatomy, the round window, and the facial nerve course, while MRI confirms that the cochlear nerve is present and that the cochlea is filled with fluid rather than fibrous tissue or bone after meningitis. Labyrinthitis ossificans can obstruct electrode insertion, so early detection after meningitis influences the timing of implantation.
Principle: After meningitis, MRI confirms a patent fluid-filled cochlea before implantation.

B24.2 Answer E
Cholesteatoma is an accumulation of keratinizing squamous epithelium that erodes bone. Acquired pars flaccida cholesteatoma begins in Prussak space lateral to the ossicles and erodes the scutum and the head of the malleus and body of the incus, while pars tensa cholesteatoma involves the posterior tympanum and sinus tympani. Recognizing the origin helps the surgeon anticipate hidden extension. CT shows the extent.
Principle: Pars flaccida cholesteatoma erodes the scutum, malleus head, and incus body.

B24.3 Answer C
Complications of cholesteatoma are reported systematically. They include ossicular erosion, a fistula of the lateral semicircular canal, dehiscence of the tegmen with risk of intracranial extension, and erosion of the facial nerve canal. A labyrinthine fistula is the most common and threatens hearing during surgery, so its presence is stated so the surgeon can plan removal of matrix over the fistula with care.
Principle: Lateral canal fistula is the most common cholesteatoma complication.

B24.4 Answer A
Interpretation of diffusion-weighted imaging for cholesteatoma avoids several pitfalls. Diffusion images are read with the ADC map and with T1-weighted and T2-weighted images, which improve characterization, and ADC values increase specificity. Cerumen, abscess, cholesterol granuloma, and susceptibility artifact can mimic cholesteatoma. T1 hyperintensity is the key clue to cholesterol granuloma, whereas cholesteatoma is not bright on T1. ADC values add specificity.
Principle: A T1-bright middle ear lesion suggests cholesterol granuloma, not cholesteatoma.

B24.5 Answer D
Necrotizing otitis externa is a separate infection of older patients with diabetes or immunosuppression, usually caused by Pseudomonas. It spreads from the external auditory canal into the skull base, the infratemporal fossa, and the temporomandibular joint, and can cause facial and lower cranial nerve palsies. CT shows erosion of bone, and MRI shows soft tissue and marrow involvement, which helps define the extent of disease.
Principle: Skull base spread from the ear canal in diabetics suggests necrotizing otitis externa.

B24.6 Answer A
The report on a temporal bone fracture states whether the fracture crosses the cochlea, vestibule, or semicircular canals. It also describes ossicular disruption, most often incudostapedial separation or incus dislocation, involvement of the facial nerve canal, especially near the geniculate ganglion, and fractures crossing the carotid canal. Conductive loss after trauma therefore prompts careful review of the incus and its articulations.
Principle: Incudostapedial separation is the most common post-traumatic ossicular injury.

B24.7 Answer B
The imaging features separate vestibular schwannoma from meningioma. A schwannoma is centered on the porus acusticus, extends into and widens the internal auditory canal, forms an acute angle with the petrous bone, and has an ice cream cone shape, sometimes with cysts. A meningioma is broad based along the dura, often eccentric to the porus, and forms an obtuse angle with the bone, sometimes with a dural tail.
Principle: A broad dural-based angle mass with an obtuse angle suggests meningioma.

B24.8 Answer C
After surgery for vestibular schwannoma, linear enhancement in the operative bed is common and stable, whereas nodular enhancement that grows on serial studies indicates residual or recurrent tumor. The shape and behavior of enhancement over time, rather than its presence alone, determine the interpretation. Stable linear enhancement therefore needs only continued surveillance, not treatment, unless it becomes nodular or enlarges on later studies.
Principle: Stable linear postoperative enhancement is expected; growing nodules suggest recurrence.

B24.9 Answer E
Vertigo has a broad differential. Peripheral vestibular disorders usually have normal imaging, while sudden vertigo with central signs or vascular risk factors raises concern for posterior circulation stroke, for which MRI with diffusion is needed. Delayed postcontrast imaging of the inner ear can show endolymphatic hydrops in Meniere disease, supporting the clinical diagnosis of episodic vertigo with fluctuating hearing loss and aural fullness.
Principle: Delayed postcontrast inner ear MRI can show hydrops in Meniere disease.

B24.10 Answer D
Pulsatile tinnitus has a structural cause in many patients. A vascular retrotympanic mass suggests a glomus tympanicum or jugulare paraganglioma, an aberrant internal carotid artery, or a dehiscent or high jugular bulb, all of which CT distinguishes. A mass on the cochlear promontory with an intact jugular plate is a glomus tympanicum, whereas a jugulare tumor erodes the jugular foramen from below.
Principle: A promontory mass with an intact jugular plate is a glomus tympanicum.

Chapter 25: Sinonasal Disease, Skull Base, and Cranial Nerves

B25.1 Answer A
Several chronic sinus patterns are recognizable on CT. Hyperdense contents expanding the sinuses with a serpiginous pattern suggest allergic fungal sinusitis, a fungus ball forms a hyperdense mass with calcifications in a single sinus, usually the maxillary sinus, and a mucocele expands and remodels the walls of an obstructed sinus. Expansion of several sinuses with hyperdense material in an atopic patient therefore favors allergic fungal disease.
Principle: Expanded sinuses with serpiginous hyperdense contents suggest allergic fungal sinusitis.

B25.2 Answer D
A fungus ball forms a hyperdense mass with calcifications in a single sinus, usually the maxillary sinus, in an immunocompetent patient. It is noninvasive and is treated by surgical removal. By contrast, allergic fungal sinusitis expands several sinuses with serpiginous hyperdense contents, and acute invasive fungal sinusitis occurs in immunocompromised patients and infiltrates the fat around the sinus rather than forming a calcified mass.
Principle: A calcified hyperdense mass in one maxillary sinus suggests a fungus ball.

B25.3 Answer B
Complications of sinusitis are both orbital and intracranial. Frontal sinusitis can cause osteomyelitis of the frontal bone with a subperiosteal abscess, the Pott puffy tumor, and epidural or subdural empyema, meningitis, and frontal lobe abscess. These complications are most common in adolescent boys, and MRI is more sensitive than CT for intracranial spread, so it is obtained when this complication is suspected.
Principle: MRI is more sensitive than CT for intracranial spread of sinusitis.

B25.4 Answer C
Odontogenic sinusitis is easy to overlook. Unilateral maxillary sinus disease in an adult, especially with a foul smell, often comes from a periapical abscess, a dental implant, or an oroantral fistula after extraction. CT shows periapical lucency around a maxillary molar root or dehiscence of the sinus floor, and the report names the dental source, because sinus surgery alone fails without dental treatment.
Principle: Unilateral foul maxillary sinusitis with periapical lucency is odontogenic.

B25.5 Answer E
Infiltration of the fat behind the maxillary sinus, in front of and behind its posterior wall, is an early and important sign of acute invasive fungal sinusitis. CT findings can be subtle early, and mucosal thickening may be mild. MRI better shows spread into the orbit, cavernous sinus, and brain. In an immunocompromised patient, this sign warrants urgent endoscopic evaluation and biopsy, because delay worsens outcome.
Principle: Retroantral fat infiltration is an early sign of invasive fungal sinusitis.

B25.6 Answer B
Malignant sinonasal tumors include squamous cell carcinoma, adenocarcinoma linked to wood dust exposure, adenoid cystic carcinoma with perineural spread, olfactory neuroblastoma at the cribriform plate, sinonasal undifferentiated carcinoma, lymphoma, and melanoma. Olfactory neuroblastoma often forms a dumbbell mass across the cribriform plate with cysts at its intracranial margin, a pattern that strongly suggests the diagnosis and directs evaluation of the dura and frontal lobes.
Principle: A dumbbell mass across the cribriform plate with marginal cysts suggests esthesioneuroblastoma.

B25.7 Answer E
Chondrosarcomas are usually off midline, along the petro-occipital fissure, and bright on T2-weighted images, with chondroid calcifications in rings and arcs on CT. The distinction from chordoma, which is typically midline in the clivus, matters because chondrosarcomas have a better prognosis. Diffusion helps, with higher ADC values in chondrosarcoma than in chordoma, which adds confidence when the location is borderline.
Principle: Off-midline petro-occipital chondroid tumor is chondrosarcoma, with better prognosis.

B25.8 Answer D
Skull base meningiomas, schwannomas, and paragangliomas complete the common masses. Jugular foramen paragangliomas erode the bone with a permeative moth-eaten pattern and show a salt-and-pepper appearance with flow voids on MRI, whereas jugular foramen schwannomas smoothly enlarge the foramen with scalloped margins. The bone pattern on CT and the flow voids on MRI are therefore complementary in separating the two lesions.
Principle: Moth-eaten erosion with salt-and-pepper signal indicates jugular paraganglioma.

B25.9 Answer A
Bell palsy causes smooth enhancement of the facial nerve in the fundal and labyrinthine segments and does not routinely need imaging. Atypical features, slow progression, or failure to recover after several months prompt MRI to exclude a facial nerve tumor or perineural spread from a parotid malignancy. The parotid gland and the full course of the nerve through the temporal bone are therefore examined on such a study.
Principle: Nonrecovering facial palsy needs MRI to exclude tumor or perineural spread.

B25.10 Answer C
Lower cranial neuropathies need imaging below the skull base. Hoarseness from recurrent laryngeal nerve palsy requires imaging down to the aortopulmonary window on the left and the subclavian artery on the right, because the nerves loop around these structures. Hypoglossal palsy requires attention to the hypoglossal canal, the carotid space, and the tongue, where denervation causes fatty atrophy of the affected half.
Principle: Left recurrent laryngeal palsy needs imaging to the aortopulmonary window.

Chapter 26: Neck Spaces, Lymph Nodes, Thyroid, and Head and Neck Cancer

B26.1 Answer A
Salivary gland tumors deserve a closer look. Pleomorphic adenoma is well defined, lobulated, and very bright on T2-weighted images, Warthin tumor occurs in older smokers, is often multiple or bilateral, and takes up pertechnetate, and malignant tumors show ill-defined margins, low T2 signal, restricted diffusion, and perineural spread. Marked T2 brightness with smooth lobulated margins therefore favors pleomorphic adenoma in this patient.
Principle: A lobulated, very T2-bright parotid mass suggests pleomorphic adenoma.

B26.2 Answer E
Warthin tumor occurs in older smokers, is often multiple or bilateral, and takes up pertechnetate, which distinguishes it from most other salivary tumors. Pleomorphic adenoma is usually solitary and very bright on T2-weighted images, and malignant tumors show ill-defined margins, low T2 signal, restricted diffusion, and perineural spread. Bilateral masses in an older smoker with pertechnetate uptake are therefore typical of Warthin tumor.
Principle: Bilateral parotid masses with pertechnetate uptake in a smoker suggest Warthin tumor.

B26.3 Answer B
Below the hyoid bone, the visceral space contains the thyroid and parathyroid glands. Parathyroid adenomas lie behind or below the thyroid and show early arterial enhancement with washout on four-dimensional CT, and ectopic glands may lie in the carotid sheath, the tracheoesophageal groove, or the mediastinum. The enhancement pattern helps separate an adenoma from a lymph node or a thyroid nodule on the same study.
Principle: Parathyroid adenomas enhance early and wash out on 4D CT.

B26.4 Answer D
Size criteria for cervical nodes remain imperfect. In a study of 2719 nodes in 71 neck dissection specimens, the minimal axial diameter was the most accurate size criterion, with 10 mm the most effective threshold and 11 mm in the subdigastric region. Groups of three or more borderline nodes increased sensitivity without significantly decreasing specificity, so clustering of nodes is reported along with size.
Principle: Use minimal axial diameter: 10 mm, or 11 mm in the subdigastric region.

B26.5 Answer C
Necrosis is the most specific sign of nodal metastasis, but extension beyond the node is also important. Extranodal extension appears as irregular nodal margins, infiltration of the surrounding fat, and invasion of muscle or vessels, and encasement of the carotid artery affects resectability. Extranodal extension changes nodal staging and treatment, so it is described explicitly whenever these features are present on CT or MRI.
Principle: Irregular margins and fat or muscle invasion indicate extranodal extension.

B26.6 Answer D
Nonmalignant nodal disease also has patterns. Reactive nodes are oval with a fatty hilum and preserved architecture, tuberculous lymphadenitis produces necrotic, matted nodes with surrounding inflammation and sometimes calcification, and lymphoma produces multiple large homogeneous nodes, often bilateral and in unusual sites such as the occipital and parotid regions. Matting, necrosis, and calcification together favor tuberculosis, confirmed by aspiration and culture.
Principle: Matted necrotic calcified neck nodes suggest tuberculous lymphadenitis.

B26.7 Answer B
Human papillomavirus status has a strong effect on survival. In a trial of patients with stage III or IV oropharyngeal squamous cell carcinoma, 63.8% had HPV-positive tumors, and these patients had a 3-year overall survival of 82.4%, compared with 57.1% for HPV-negative tumors. This difference led to a separate staging algorithm for HPV-associated disease, so the report notes when imaging features suggest HPV-related cancer.
Principle: HPV-positive oropharyngeal cancer has markedly better survival.

B26.8 Answer E
Squamous cell carcinoma presenting as a neck node without an obvious primary site is a common referral. Careful review of the tonsils, the base of tongue, and the nasopharynx, where small primary tumors hide, comes first, and asymmetric tonsillar or lingual tonsil enhancement is reported. FDG PET-CT before biopsy and endoscopy helps find the primary site, because biopsy can produce uptake that obscures a small tumor.
Principle: Search the tonsils, base of tongue, and nasopharynx for an occult primary.

B26.9 Answer A
Timing affects the accuracy of posttreatment PET-CT. It is usually performed about 12 weeks after the end of radiation, when inflammatory uptake has subsided, and mild uptake at a flap margin or in an irradiated mucosal surface is common. Imaging too early increases false-positive results from treatment-related inflammation, which can lead to unnecessary biopsy or neck dissection in patients who have responded.
Principle: Perform posttreatment PET-CT about 12 weeks after radiation.

B26.10 Answer C
Incidental thyroid nodules on CT, MRI, or nuclear medicine studies are among the most common incidental findings, and most are benign. In practice, ultrasound is recommended for incidental nodules with suspicious features, such as abnormal lymph nodes or invasion, for nodules of 1 cm or larger in patients younger than 35 years, and for nodules of 1.5 cm or larger in older patients, while smaller nodules need no further evaluation.
Principle: Incidental nodules 1 cm or larger under age 35 need ultrasound.

Chapter 27: Degenerative Spine Disease

B27.1 Answer A
Sequestration is an extrusion in which displaced material has lost continuity with the parent disc, and migration describes displacement away from the site of extrusion. Location is described in the axial plane as central, subarticular, foraminal, or extraforaminal, and in the craniocaudal plane relative to the disc and pedicle. Using standard terms makes reports comparable over time and between readers and helps surgical planning.
Principle: A disc fragment without continuity to the parent disc is a sequestration.

B27.2 Answer B
The postoperative lumbar spine raises a specific question. Recurrent herniation after discectomy is avascular and enhances only at its periphery, while epidural scar enhances homogeneously on early postcontrast images, so contrast-enhanced MRI is used when symptoms return after surgery. The distinction matters because a recurrent herniation may benefit from further surgery, whereas scar tissue usually does not, and the timing of contrast images matters.
Principle: Peripherally enhancing postoperative epidural tissue is recurrent herniation; scar enhances homogeneously.

B27.3 Answer D
Thoracic disc herniations are less common than lumbar herniations, are often calcified, and large ones can compress the cord. CT shows calcification, which affects the surgical approach. The level is counted carefully from the sacrum or the cervical spine, because miscounting is a recognized cause of wrong-level surgery, and the report states the reference point used so that the surgeon can reproduce the count in theater.
Principle: Count thoracic levels carefully to prevent wrong-level surgery.

B27.4 Answer C
Endplate marrow changes accompany degeneration. In 474 consecutive patients, type 1 changes, low on T1-weighted and high on T2-weighted images, were found in 4%, and type 2 changes, high on T1-weighted images, in 16%. Type 1 changes reflected fissured endplates with vascularized fibrous tissue, type 2 changes reflected yellow marrow replacement, and type 1 changes converted to type 2 in five of six patients followed over time.
Principle: Modic type 2 change reflects fatty marrow replacement.

B27.5 Answer E
Modic type 1 changes must be separated from infection. Discitis and osteomyelitis also cause marrow edema on both sides of a disc, but they usually show destruction of the endplates, fluid signal and enhancement within the disc, and paraspinal or epidural inflammation, while degenerative type 1 changes preserve the endplate outline. When findings are equivocal, inflammatory markers and follow-up imaging help clarify the diagnosis.
Principle: Preserved endplates without disc fluid or soft tissue inflammation favor Modic 1 over infection.

B27.6 Answer B
Facet joint degeneration causes degenerative spondylolisthesis, typically at L4-L5 in older women. Spondylolysis, by contrast, is a defect of the pars interarticularis that causes isthmic spondylolisthesis, most often at L5-S1. The distinction affects treatment, because isthmic slips arise from a bony defect in younger patients and are often associated with activities involving repeated extension, whereas degenerative slips arise from facet arthrosis.
Principle: Isthmic spondylolisthesis from pars defects is most common at L5-S1.

B27.7 Answer D
Cord signal change in cervical myelopathy carries prognostic meaning. Hyperintensity on T2-weighted images may reflect edema or gliosis and can be reversible, while focal T1 hypointensity indicates more permanent injury. A snake-eyes pattern of bilateral anterior horn hyperintensity on axial images reflects gray matter injury in chronic compression. The pattern supports a chronic process and is reported with the levels of compression.
Principle: Snake-eyes anterior horn signal reflects chronic compressive gray matter injury.

B27.8 Answer E
Ossification of the posterior longitudinal ligament is best seen on CT, which shows its extent and thickness and whether it involves the dura. Dural involvement increases the risk of cerebrospinal fluid leak during anterior surgery. Dynamic flexion and extension imaging is used selectively to show compression that appears only in extension. The report states the levels of cord compression and the remaining canal diameter for surgical planning.
Principle: CT best shows the extent of OPLL and dural involvement.

B27.9 Answer C
Cervical radiculopathy comes mainly from foraminal narrowing by uncovertebral and facet osteophytes, less often from soft disc herniation. Oblique sagittal reformats perpendicular to the foramina show the narrowing more reliably than standard planes. The report matches the level to the symptoms, remembering that cervical roots exit above the pedicle of the same-numbered vertebra, so the C6 root exits at C5-C6, unlike the lumbar arrangement.
Principle: The C6 root exits at C5-C6, above the C6 pedicle.

B27.10 Answer A
Imaging findings are common in people without pain. A systematic review of 3110 asymptomatic individuals found that disc degeneration increased from 37% at age 20 to 96% at age 80, and disc bulges from 30% to 84%. Brief statements in reports that degenerative findings are common in people without symptoms reduce anxiety and unnecessary treatment, while emphasis falls on the findings that match the symptoms.
Principle: Disc degeneration is common in asymptomatic people and rises with age.

Chapter 28: Spinal Cord Disease

B28.1 Answer E
Several features organize the differential of myelopathy. The length of the lesion separates short segments from longitudinally extensive lesions, and the axial distribution separates peripheral white matter lesions from central gray matter, anterior horn, or dorsal column involvement. Onset over minutes to hours suggests infarction, over days to weeks inflammation, and over months compression, vascular malformation, tumor, or deficiency, which shapes the search for a cause.
Principle: Myelopathy evolving over months suggests compression, malformation, tumor, or deficiency.

B28.2 Answer A
Infectious myelitis follows its own patterns. Herpes viruses and enteroviruses cause gray matter or longitudinal lesions, acute flaccid myelitis in children selectively affects the anterior horns, HIV causes vacuolar myelopathy of the dorsal columns, and schistosomiasis produces a conus lesion with nodular enhancement. Selective anterior horn involvement after a respiratory illness with flaccid weakness therefore points to acute flaccid myelitis in this child.
Principle: Anterior horn involvement with flaccid weakness in a child suggests acute flaccid myelitis.

B28.3 Answer D
Infectious myelitis follows its own patterns. Herpes viruses and enteroviruses cause gray matter or longitudinal lesions, acute flaccid myelitis affects the anterior horns, HIV causes vacuolar myelopathy of the dorsal columns, and schistosomiasis produces a conus lesion with nodular enhancement. A freshwater exposure history in an endemic region with a nodular enhancing conus lesion makes schistosomiasis the leading diagnosis, and early treatment improves neurological recovery.
Principle: A nodular enhancing conus lesion after freshwater exposure suggests schistosomiasis.

B28.4 Answer B
Infectious myelitis follows its own patterns, but some myelopathies are immune reactions to a distant tumor. Paraneoplastic myelitis is symmetric and tract specific, and the search for a cancer follows. The imaging pattern prompts testing for paraneoplastic antibodies and a body imaging search, often with FDG PET-CT, because treatment of the underlying tumor is central to management and the neurological syndrome may precede the cancer diagnosis.
Principle: Symmetric tract-specific myelitis prompts a search for cancer.

B28.5 Answer C
Spinal cord cavernous malformations cause stepwise or acute myelopathy from repeated small hemorrhages. MRI shows a mulberry lesion with mixed signal and a complete hemosiderin rim that is dark on gradient-echo images, without a feeding artery, and brain imaging may show further cavernous malformations in familial forms. The absence of a feeding vessel and the complete rim separate it from tumors and arteriovenous malformations.
Principle: A mulberry cord lesion with a complete hemosiderin rim is a cavernous malformation.

B28.6 Answer D
Ependymomas are the most common intramedullary tumor in adults and astrocytomas the most common in children, and together they make up to 70% of intramedullary neoplasms. A central location, a cleavage plane, and intense homogeneous enhancement favor ependymoma, while astrocytomas are usually eccentric, ill defined, and patchily enhancing. The child's age and the eccentric, ill-defined appearance therefore both favor astrocytoma in this case.
Principle: Eccentric, ill-defined, patchy cord tumors in children are usually astrocytomas.

B28.7 Answer C
Metastases to the cord show prominent edema for the size of the enhancing portion. Hemangioblastomas also produce edema out of proportion to their size, but they form a nodule at the dorsal pial surface with a large syrinx and flow voids, and they occur in younger patients, often with von Hippel-Lindau disease. A known primary cancer and a small nodule with extensive edema favor metastasis.
Principle: A small enhancing cord nodule with disproportionate edema suggests metastasis.

B28.8 Answer A
Distinguishing tumor from inflammation can require follow-up. Inflammatory lesions usually change within weeks, either improving or evolving, while tumors grow slowly. When the distinction is uncertain, a short-interval study after treatment of a possible inflammatory cause is more useful than an immediate biopsy of the cord, which carries a risk of neurological injury. The report recommends the interval and the features to compare.
Principle: Short-interval follow-up often separates myelitis from cord tumor without biopsy.

B28.9 Answer E
Other compressive causes include epidural metastases and abscesses, epidural lipomatosis, and ventral cord herniation through a dural defect in the thoracic spine. Spinal cord herniation and arachnoid webs can both produce a dorsal indentation of the cord, and the shape of the indentation separates them: a web causes a sharp scalpel sign, and herniation causes anterior displacement with a widened dorsal subarachnoid space.
Principle: A dorsal scalpel sign on sagittal MRI indicates an arachnoid web.

B28.10 Answer B
Radiation myelopathy appears months to years after radiation to a field that includes the cord, such as for head and neck or lung cancer. MRI shows T2 hyperintensity and sometimes swelling and enhancement confined to the treated segment, with fatty marrow replacement in the adjacent vertebral bodies marking the radiation field. The match between the cord abnormality and the marrow change supports the diagnosis over metastasis.
Principle: Fatty marrow in adjacent vertebrae marks the field in radiation myelopathy.

Chapter 29: Spine Trauma, Infection, and Vertebral Tumors

B29.1 Answer C
When imaging is needed in adults, thin-section CT with sagittal and coronal reconstructions has replaced radiographs for cervical spine trauma. CT angiography of the neck is added when the fracture pattern suggests vertebral artery injury, such as fractures through the transverse foramen, subluxation, or upper cervical fractures. Detecting blunt vertebral artery injury allows antithrombotic treatment that can reduce the risk of stroke after injury.
Principle: Fractures through the transverse foramen prompt CT angiography for vertebral artery injury.

B29.2 Answer E
Several spinal injury patterns deserve particular mention. Chance fractures are flexion-distraction injuries of the thoracolumbar junction associated with bowel injury, typically in restrained occupants wearing only a lap belt. The horizontal fracture through the body and posterior elements is a tension band injury and is unstable. The abdominal CT is therefore reviewed carefully for bowel wall thickening, free fluid without solid organ injury, and mesenteric stranding.
Principle: Chance fractures are associated with bowel injury.

B29.3 Answer B
Fractures in an ankylosed spine, from ankylosing spondylitis or diffuse idiopathic skeletal hyperostosis, behave like long-bone fractures, are often subtle, and are highly unstable. Even a low-energy fall can produce a fracture through a fused segment, and displacement can cause cord injury. CT of the whole spine is obtained, and MRI is added for neurological deficit or epidural hematoma, because a second noncontiguous fracture may be present.
Principle: Fractures in an ankylosed spine are subtle and highly unstable.

B29.4 Answer A
Craniocervical junction injuries need their own measurements. Odontoid fractures are classified by level, with type II fractures through the base of the dens most prone to nonunion, and a widened atlantodental interval or lateral mass overhang indicates transverse ligament injury. Type II fractures are common in older adults after low-energy falls, and the risk of nonunion influences the choice between surgical fixation and external immobilization.
Principle: Type II odontoid fractures through the base of the dens are most prone to nonunion.

B29.5 Answer D
Craniocervical junction injuries need their own measurements. Atlanto-occipital dissociation widens the basion-dens interval and the condyle-C1 interval, and the occipital condyles and C1 ring are examined on every trauma CT. A widened atlantodental interval or lateral mass overhang indicates transverse ligament injury, which makes a C1 fracture unstable and often leads to surgical stabilization, so MRI can be used to confirm ligament disruption.
Principle: Lateral mass overhang or a wide atlantodental interval indicates transverse ligament injury.

B29.6 Answer C
Some features help identify the organism in spinal infection. Tuberculous spondylitis tends to spare the disc until late, spread beneath the anterior longitudinal ligament to several levels, and form large paraspinal abscesses with thin, smooth walls and calcification. Pyogenic infection more often destroys the disc early and forms smaller, thick-walled collections. Blood cultures or biopsy remain necessary to identify the organism and guide antibiotics.
Principle: Early disc destruction with small thick-walled collections favors pyogenic infection.

B29.7 Answer D
Primary bone tumors and myeloma also involve the spine. Hemangiomas contain fat and coarse vertical trabeculae, giving a corduroy appearance on radiographs and CT and high T1 signal on MRI, while aggressive hemangiomas lack fat and can extend into the epidural space. A lesion with fat and vertical trabeculae is a typical hemangioma that needs no follow-up, whereas lack of fat raises concern for an aggressive variant or other tumor.
Principle: Fat with vertical trabeculae indicates a typical vertebral hemangioma.

B29.8 Answer A
Myeloma causes diffuse or focal marrow replacement with lytic lesions and fractures, and whole-body low-dose CT or MRI is used to stage it. These techniques detect more lesions than radiographs, and bone scintigraphy is unreliable because myeloma lesions often do not stimulate osteoblastic activity. Imaging also identifies fractures at risk and soft tissue extension that may compress the cord or nerve roots.
Principle: Stage myeloma with whole-body low-dose CT or MRI.

B29.9 Answer E
Epidural spinal cord compression is graded from 0, disease confined to bone, through grade 1 epidural disease that does not compress the cord, to grades 2 and 3 with cord compression. Grades 2 and 3 are high grade, and with radioresistant tumors they usually lead to surgical decompression followed by stereotactic radiation, while low-grade compression is often treated with radiation alone. The grade is therefore stated for each level.
Principle: Low-grade epidural compression is often treated with radiation alone.

B29.10 Answer B
Other compressive lesions in patients with cancer include epidural hematoma after procedures or with coagulopathy, epidural lymphoma that can encase the cord without bone destruction, and leptomeningeal metastases along the cauda equina. Most epidural metastases from solid tumors extend from an involved vertebral body, so an epidural mass with normal bone favors lymphoma, which spreads through the neural foramina from paraspinal disease.
Principle: Epidural tumor encasing the cord without bone destruction suggests lymphoma.

Chapter 30: Congenital Malformations and Pediatric Neuroradiology

B30.1 Answer E
Each malformation of cortical development has signs to look for. Periventricular nodular heterotopia forms nodules of gray matter signal along the ventricles, polymicrogyria forms many small gyri with an irregular gray-white junction, often around the Sylvian fissure, and schizencephaly forms a gray matter-lined cleft extending from the ventricle to the surface. The gray matter lining distinguishes schizencephaly from a porencephalic cavity, which is lined by gliotic white matter.
Principle: A gray matter-lined cleft from ventricle to surface is schizencephaly.

B30.2 Answer A
Hemimegalencephaly enlarges all or part of one hemisphere with dysplastic cortex, abnormal white matter, and an enlarged ventricle, and it causes severe early epilepsy that may need hemispherectomy. Recognizing it early allows referral for epilepsy surgery, which can improve seizure control and development. The enlarged ventricle on the abnormal side helps separate it from conditions that cause hemispheric atrophy, in which the ventricle enlarges because tissue is lost.
Principle: Hemimegalencephaly enlarges one hemisphere and may need hemispherectomy.

B30.3 Answer B
Cystic posterior fossa malformations are separated by the vermis and the fourth ventricle. Dandy-Walker malformation has an enlarged posterior fossa with a hypoplastic, rotated vermis and a cystic fourth ventricle extending to an elevated tentorium. Blake pouch cyst has a normal vermis that is displaced by a cyst communicating with the fourth ventricle, and mega cisterna magna has a normal vermis and fourth ventricle with an enlarged cisterna magna.
Principle: A normal displaced vermis with a fourth ventricle cyst suggests Blake pouch cyst.

B30.4 Answer D
Sturge-Weber syndrome causes leptomeningeal angiomatosis, usually over the occipital and parietal lobes on the side of a facial port-wine birthmark. Postcontrast images show leptomeningeal enhancement, and later findings include cortical calcification with a tram-track pattern on CT, atrophy of the underlying hemisphere, and an enlarged choroid plexus. Early MRI may show only enhancement before calcification develops, so contrast is used when the diagnosis is suspected in infancy.
Principle: Port-wine stain with tram-track calcification indicates Sturge-Weber syndrome.

B30.5 Answer C
Optic pathway gliomas in neurofibromatosis type 1 cause fusiform enlargement of the optic nerves and chiasm and are usually indolent. Plexiform neurofibromas infiltrate along nerves with a target sign on T2-weighted images, central low signal surrounded by high signal. Sphenoid wing dysplasia, dural ectasia, and moyamoya vasculopathy complete the neuroimaging features. Rapid growth, pain, or loss of the target sign raises concern for malignant transformation.
Principle: A target sign along infiltrated nerves indicates plexiform neurofibroma.

B30.6 Answer E
Tuberous sclerosis complex has updated criteria in which multiple cortical tubers or radial migration lines replaced the more general term cortical dysplasias, and sclerotic bone lesions were reinstated as a minor criterion. Surveillance places increased emphasis on early electroencephalographic screening and on neuropsychiatric assessment. The more specific terms reduce confusion with other malformations and make the criteria easier to apply from imaging reports.
Principle: TSC criteria use cortical tubers or radial migration lines, not 'cortical dysplasias'.

B30.7 Answer A
Timing of MRI affects what it shows after neonatal hypoxic-ischemic injury. Diffusion restriction appears in the first days and pseudonormalizes by about the end of the first week, while T1 and T2 signal changes in the basal ganglia become clearer in the second week, so imaging between days 4 and 7 is commonly used after therapeutic hypothermia. Imaging too late may underestimate injury on diffusion images.
Principle: After hypothermia, neonatal MRI is commonly obtained between days 4 and 7.

B30.8 Answer C
Loss of the normal posterior limb of the internal capsule T1 hyperintensity at term is an important sign of injury, and spectroscopy showing elevated lactate in the deep gray matter predicts poor outcome. The posterior limb normally shows T1 hyperintensity from myelination by term, so its absence in a term infant after a hypoxic event signals injury to the deep structures and is associated with adverse motor outcome.
Principle: Absent PLIC T1 hyperintensity at term signals injury.

B30.9 Answer D
Imaging for closed dysraphism begins with ultrasound in infants, while the posterior elements are still largely cartilaginous, and continues with MRI when ultrasound is abnormal or the cutaneous markers are high risk. Markers include a lumbosacral lipoma, a hairy patch, a dermal sinus above the gluteal crease, and a hemangioma, while a simple dimple low in the gluteal crease carries little risk and usually needs no imaging in an otherwise normal infant.
Principle: A simple dimple low in the gluteal crease carries little risk.

B30.10 Answer B

Closed dysraphism without a mass is simple or complex. Simple forms include a tight filum terminale and intradural lipoma, and complex forms include split cord malformations and caudal regression. Split cord malformations divide the cord into two hemicords, with a bony or fibrous septum in type I and without one in type II, and syringomyelia and vertebral segmentation anomalies often accompany them. Surgical removal of the septum relieves tethering.

Principle: A bony septum between hemicords defines type I split cord malformation.