CHAPTER **C44** Atlas of Neuroimaging

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Figure e44-1 Limbic encephalitis (Chap. 101) Coronal (A, B), axial fluid-attenuated inversion recovery (FLAIR) (C, D), and axial T2-weighted (E) MR images demonstrate abnormal high signal involving the









bilateral mesial temporal lobes (arrowheads) including the hippocampi (left greater than right) without significant mass effect (arrows). There was no enhancement on postgadolinium images (not shown).





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Figure e44-2 CNS tuberculosis (Chap. 165)

Axial T2-weighted MRI (A) demonstrates multiple lesions (*arrows*) with peripheral high signal and central low signal, located predominantly in the cortex and subcortical white matter, as well as in the basal ganglia. Axial T1-weighted MR images postgadolinium (B, C) demonstrate ring enhancement of the lesions (*arrows*) and additional lesions in the subarachnoid space (*arrowheads*).



Sagittal T2-weighted MR image of the cervical spine (**D**) demonstrates a hypointense lesion in the subarachnoid space at the level of T5 (*arrow*). Sagittal T1-weighted MR image postgadolinium of the cervical spine (**E**) demonstrates enhancement of the lesion in the subarachnoid space at the level of T5 (*arrow*).







A

Axial T2-weighted MR images (A, B) demonstrate well-defined areas of abnormal high signal in the basal ganglia bilaterally and in a wedge-shaped distribution in the right parietal lobe (arrows).



D



Figure e44-3 (continued)



Figure e44-4 Neurosyphilis (Chap. 169) Case II

Axial T2-weighted MRI (*A*) demonstrates a dural-based, peripherally hyperintense and centrally hypointense lesion located lateral to the left frontal lobe (*arrow*).

C

Axial (**B**) and coronal (**C**) T1-weighted MR images postgadolinium demonstrate peripheral enhancement of the lesion (*arrows*).

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Figure e44-5 Histoplasmosis of the pons (Chap. 199) Axial FLAIR (*A*) and T2-weighted (*B*) MR images demonstrate a low signal mass in the right pons (*arrows*) with surrounding vasogenic edema.

Axial T1-weighted MR image postgadolinium (C) demonstrates ring enhancement of the lesion in the right pons (*arrow*). Of note, there was no evidence of restricted diffusion (not shown).





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Figure e44-6Coccidiomycosis meningitis (Chap. 200)Axial postcontrast CT (A) and axial (B) and coronal (C) T1-weighted MR

images postgadolinium demonstrate enhancement of the perimesencephalic cisterns (*arrows*), as well as the sylvian and interhemispheric fissures.

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ADC map (D, E) demonstrates restricted diffusion of water molecules in the lesions (arrowheads).

Figure e44-7 Candidiasis in a newborn (Chap. 203)

Axial T2-weighted MR image (A) demonstrates multiple punctate foci of low signal diffusely distributed in the brain parenchyma (*arrowhead*). Axial T1-weighted MR images postgadolinium (B, C) demonstrate marked enhancement of the lesions (arrowheads).

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Figure e44-8 CNS aspergillosis (Chap. 204) Axial FLAIR MR images (*A*, *B*) demonstrate multiple areas of abnormal high signal in the basal ganglia as well as cortex and subcortical white matter (arrows). There is also abnormal high signal in the subarachnoid space adjacent to the lesions (arrowheads) that can correspond to blood or high protein content.



D

Axial T2-weighted MR images (C, D) demonstrate intrinsic low signal in the lesions (arrows), suggesting the presence of blood products. Some of the lesions also show vasogenic edema. Coronal (E) and axial (F) T1-weighted MR images postgadolinium demonstrate peripheral enhancement of the lesions (arrows).

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Figure e44-8 (continued)



Figure e44-9 Invasive sinonasal aspergillosis (Chap. 204) Axial T2-weighted MR image (*A*) demonstrates an irregularly shaped low signal lesion involving the left orbital apex (*arrow*). *B*. T1-weighted image pregadolinium demonstrates low signal in left anterior clinoid process (*arrow*).



C. T1-weighted image postgadolinium demonstrates enhancement of lesion (*arrow*).



Figure e44-9 (continued)



Figure e44-10 Behçet's disease (Chap. 327) Axial FLAIR MRI demonstrates abnormal high signal involving the anterior pons (*arrow*); following gadolinium administration, the lesion was nonenhancing (not shown). Brainstem lesions are typical of Behçet's disease, caused primarily by vasculitis and in some cases demyelinating lesions.







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Coronal (A) and axial (B) T1-weighted images postgadolinium with fat suppression demonstrate a homogeneously enhancing well-circumscribed mass centered in the left Meckel's cave (arrows).







Figure e44-12 Neurosarcoid (Chap. 329) Case II

Axial (A, B) and sagittal (C) T1-weighted images postgadolinium with fat suppression demonstrate a homogeneously enhancing mass involving the hypothalamus and the pituitary stalk (*arrows*).



expansion in the midbrain, dorsal pons, and pineal region (arrows) without

Α

significant mass effect.

Figure e44-13 Neurosarcoid (Chap. 329) Case III Axial FLAIR images (*A–E*) demonstrate abnormal high signal and slight





Sagittal T1-weighted images postgadolinium (F) with fat suppression demonstrate abnormal enhancement in the midbrain, dorsal pons, and pineal region (*arrows*).



Figure e44-13 (continued)

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pallidus, bilateral cerebral peduncles, bilateral gyrus rectus, right frontal lobe periventricular white matter, and patchy areas in bilateral temporal lobes. T1-weighted images postgadolinium (E-H) demonstrate abnormal enhancement of those areas with high T2 signal.

Axial T2-weighted images (*A–D*) demonstrate numerous areas of abnormal hyperintensity involving the corpus callosum, left internal capsule and globus



Figure e44-14 (continued)

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Figure e44-15 Histiocytosis (Chap. 340)

Sagittal T1-weighted image (**A**) demonstrates enlargement of the pituitary stalk (*arrow*) and absence of the posterior pituitary intrinsic T1 hyperintensity (*arrowhead*).

Sagittal and coronal T1-weighted images postgadolinium (*B*, *C*) demonstrate enhancement of the pituitary stalk and infundibulum (*arrows*).





Figure e44-16 Middle cerebral artery stenosis (Chap. 370) Time-of-flight (TOF) MR angiography (MRA) (*A*, *B*) reveals narrowing within the left M1 segment that is likely secondary to atherosclerosis (*arrows*).

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Figure e44-17 Lacunar infarction (Chap. 370)

Axial noncontrast CT (A) demonstrates abnormal hypodensity involving the left anterior putamen and anterior limb of internal capsule with ex-vacuo dilatation of the adjacent frontal horn of the left lateral ventricle, suggestive of an old infarction (arrow). A small area of slight hypodensity is also seen in the posterior limb of the right internal capsule that can correspond to an acute infarct (arrowhead).

Axial FLAIR MRI (B) demonstrates abnormal high signal involving the left anterior putamen and anterior limb of internal capsule with ex-vacuo dilatation







of the adjacent frontal horn of the left lateral ventricle, suggestive of an old infarction (arrow). A small area of slight hyperintensity is also seen in the posterior limb of the right internal capsule that can correspond to an acute lacunar infarct (arrowhead).

Diffusion-weighted image (C) and apparent diffusion coefficient (ADC) map (D) demonstrate restricted water motion in the lesion of the posterior limb of the right internal capsule, strongly suggestive for an acute lacunar infarct (arrowhead). There is no evidence of restricted diffusion in the old infarct (arrow).







D

Figure e44-18 Cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy (CADASIL) (Chap. 370) Axial T2-weighted MR images (A, B) demonstrate multiple patchy areas of abnormal high signal in the periventricular white matter (arrows). Coronal FLAIR

MRI (C, D) demonstrates multiple patchy areas of abnormal high signal in the periventricular white matter bilaterally, including the temporal lobes (*arrows*). In some of these areas, there are small areas of tissue loss (encephalomalacia) (arrowheads).







Figure e44-19CNS vasculitis (Chap. 370)Axial noncontrast CT (A) demonstrates a large hyperdense intraparenchymal hematoma surrounded by hypodense vasogenic edema in the right parietal lobe.

Axial T2-weighted MRI (B) demonstrates a large hypointense intraparenchymal hematoma surrounded by hyperintense vasogenic edema in the right parietal lobe.

Conventional angiography (${\pmb C})$ demonstrates multiple segments of intracranial arterial narrowing, some of which have associated adjacent areas of focal arterial dilatation. These abnormalities are suggestive of vasculitis.









Figure e44-20 Superior sagittal sinus thrombosis (Chap. 370) Noncontrast CT of the head (A) demonstrates increased density in the superior sagittal sinus, suggestive of thrombosis (arrow), and small linear hyperdensities in some temporal lobe sulci, suggestive of subarachnoid hemorrhage (arrowheads).

Axial T1-weighted MRI (B) demonstrates absence of flow void in the superior sagittal sinus, suggestive of thrombosis.

Coronal FLAIR images (C, D) demonstrate areas of abnormal high signal involving the gray and the subcortical white matter of the right frontal and left

parietal lobes, as well as the adjacent sulci. These findings are suggestive of vasogenic edema with subarachnoid hemorrhage (arrowheads). Diffusion-weighted images (E, F) and ADC maps (G, H) demonstrate restricted diffusion of the abnormal areas on FLAIR, suggestive of infarct. Phase-contrast venography of the brain (I) demonstrates absence of signal in the superior sagittal sinus down to the torcular herophili, and left transverse sinus and jugular vein.

Axial (J) and coronal (K) T1-weighted images postgadolinium demonstrate a filling defect in the superior sagittal sinus, suggestive of thrombosis.



Figure e44-20 (continued)

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Figure e44-20 (continued)



Figure e44-21 Multiple system atrophy (Chap. 372) Axial T2-weighted MR image (*A*) reveals symmetric poorly circumscribed abnormal high signal in the middle cerebellar peduncles bilaterally (*arrowheads*).



Sagittal T1-weighted MR image (B) demonstrates pontine atrophy and enlarged cerebellar fissures as a result of cerebellar atrophy (*arrows*).







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Figure e44-22 Huntington's disease (Chap. 372)

Axial noncontrast CT (*A*) demonstrates symmetric bilateral severe atrophy involving the caudate nuclei, putamen, and globus pallidi bilaterally with consequent enlargement of the frontal horns of the lateral ventricles (*arrows*). There is also diffuse prominence of the sulci indicating generalized cortical atrophy.

Axial (B) and coronal (C) FLAIR images demonstrate bilateral symmetric abnormal high signal in the caudate and putamen.

Coronal T1-weighted image (D) demonstrates enlarged frontal horns with abnormal configuration. Also note diffusely decreased marrow signal, which could represent anemia or myeloproliferative disease.

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Figure e44-23 Bell's palsy (Chap. 376)

Axial T1-weighted images postgadolinium with fat suppression (**A**–**C**) demonstrate diffuse smooth linear enhancement along the left facial nerve, involving the second and third segments (genu, tympanic, and mastoid) within the temporal bone (*arrows*). Note that there is no evidence of a mass lesion. A potential pitfall for facial nerve enhancement in the stylomastoid foramen is the enhancement of the stylomastoid artery that enters the

foramen and supplies the tympanic cavity, the tympanic antrum, mastoid cells, and the semicircular canals.

Coronal T1-weighted images postgadolinium with fat suppression (D, E) demonstrate the course of the enhancing facial nerve (*arrows*). Although these findings are highly suggestive of Bell's palsy, the diagnosis is established on clinical grounds.



Figure e44-24Spinal cord infarction (Chap. 377)

mild enhancement (arrow).

Sagittal T2-weighted MR image of the lumbar spine (*A*) demonstrates poorly defined areas of abnormal high signal in the conus medullaris and mild cord expansion (*arrow*). T1-weighted MR image of the lumbar spine postgadolinium (*B*) demonstrates Sagittal diffusion-weighted MR image of the lumbar spine (C) demonstrates restricted diffusion (*arrow*) in the areas of abnormal high signal on the T2-weighted image (A).







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Sagittal T1-weighted MR image postgadolinium (B) demonstrates abnormal enhancement in the posterior half of the cord from C2 to T1 (*arrows*).



Figure e44-26 Acute disseminated encephalomyelitis (ADEM) (Chap. 380)

Axial T2-weighted (A) and coronal FLAIR (B) images demonstrate abnormal areas of high signal involving predominantly the subcortical white matter of the frontal lobe bilaterally, and left caudate head.

Following administration of gadolinium, corresponding axial (C) and coronal (D) T1-weighted images demonstrate irregular enhancement consistent with blood-brain barrier breakdown and inflammation; some lesions show incomplete rim enhancement, typical for demyelination.





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Figure e44-27 Baló's concentric sclerosis (a variant of multiple sclerosis) (Chap. 380)

Coronal FLAIR MRI (A) demonstrates multiple areas of abnormal high signal in the supratentorial white matter bilaterally. The lesions are ovoid in shape, perpendicular to the orientation of the lateral ventricles, and with little mass effect.

Axial (B) and sagittal (C-E) T2-weighted MR images demonstrate multiple areas of abnormal high signal in the supratentorial white matter bilaterally,

as well as the involvement of the body and splenium of the corpus callosum and the callosal-septal interface (*arrowhead*). Some of the lesions reveal concentric layers, typical of Baló's concentric sclerosis (*arrows*). Sagittal (F) and axial (G, H) T1-weighted MR images postgadolinium demonstrate abnormal enhancement of all lesions with some of the lesions demonstrating concentric ring enhancement (*arrows*).

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Figure e44-27 (continued)



C encephalopathy

Axial T1-weighted images (B, C) pre- and postgadolinium demonstrate cortical/pial enhancement in the region of high signal on FLAIR.

Figure e44-28 Hashimoto's encephalopathy (Chap. 381) Axial FLAIR (*A*) demonstrates focal area of abnormal high signal involving the gray and white matter in the left frontal lobe. There is also a small area of abnormal high signal in the precentral gyrus. **PART 17**









Diffusion-weighted MR imaging (E) demonstrates abnormal reduced diffusion within the right C6, C7, C8 nerve roots and their corresponding trunks and divisions (*arrow*). These findings are compatible with radiation-induced brachial plexopathy.

Figure e44-29 Brachial plexopathy (Chap. 384) Axial (*A*), sagittal (*B*), and coronal (*C*, *D*) short tau inversion recovery (STIR) MR images demonstrate abnormal enlargement and abnormal high signal involving the right C6, C7, and C8 nerve roots, and the trunks and divisions that originate from these roots (*arrows*).





Figure e44-29 (continued)

Figure e44-31 CT facet fracture Axial CT demonstrates fracture line along the C2 facet (*arrow*).



Figure e44-30 Anterior dens dislocation Sagittal CT demonstrates the tip of the dens below the anterior arch of C2 (*arrow*), indicating anterior dislocation.



Figure e44-32 Compression fracture

Sagittal T2-weighted MRI demonstrates compression fracture of C7 (*) and high signal within the spinous processes of C6-C7 (*arrows*) and to lesser degree C5-C6. This is suggestive of interspinous ligament injury. Note the pad under the patient's neck to maintain neck alignment during the scanning time.







Figure e44-33 Epidural hematoma

Axial noncontrast CT (*A*) demonstrates a high-density epidural collection in the cervical spine (*), which is consistent with acute hemorrhage. Also noted is mass effect on the spinal cord (*arrowheads*). Sagittal reformatted CT image

(B) demonstrates the extension of the acute epidural hematoma (*) and a disk bulge (*arrowhead*), which further contributes to spinal canal narrowing. CT is the imaging procedure of choice to detect acute hematoma.



Figure e44-34Retropharyngeal soft tissue mass

Sagittal T1-weighted MRI demonstrates a hyperflexion fracture with retropulsion of the posterior wall in the canal at C5 and C6 (*arrow*). There is also a large retropharyngeal hematoma (°). The distance from the posterior wall of the airway to the anterior wall of the vertebral body should not measure more than 6 mm at C2 or more than 20 mm at C6 (mnemonic "6 at 2 and 20 at 6").



Figure e44-35 Jefferson fracture Axial CT demonstrates four fracture lines (*arrows*) separating C1 in four parts. Jefferson fracture is usually caused by axial impact to the head such as diving in shallow water.



Figure e44-36 Ligament injury after trauma Coronal CT reconstruction demonstrates abnormal asymmetry between the dens and the lateral masses of C1 indicating transverse ligament rupture.



Figure e44-38 Pathologic fracture

Sagittal T1-weighted MRI (A) demonstrates wedge-shaped T6 vertebral body (*arrow*). Sagittal postcontrast T1-weighted MRI (B) depicts tumor extension into the epidural space and the involvement of the posterior arch (*), which are highly suggestive of metastatic or primary bone tumor.





Figure e44-39 Sacral insufficiency fracture Axial T2-weighted MRI (*A*) and T1-weighted MRI (*B*) demonstrate symmetric high T2 and low T1 signal involving the sacral alae longitudinally (*arrows*).

Figure e44-37 Odontoid fracture Sagittal CT demonstrates disruption of the

Sagittal CT demonstrates disruption of the main reference cervical lines. 1: Anterior vertebral body line; 2: Posterior vertebral body line; 3: Spinolaminar line.

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Figure e44-40 Subdural hematoma Sagittal T2-weighted MRI (*A*) and axial noncontrast T1-weighted MRI (*B*) demonstrate subdural collection in the lumbosacral region (**). Note that the epidural fat is compressed but not involved (*arrow*).



Figure e44-41 Teardrop fracture Sagittal CT (A) demonstrates fracture line separating the antero-inferior corner of C6 (arrow). Sagittal T2-weighted MRI (B) displays cord injury (arrow).