FIGURE 446-14   **Axial section at the level of the midbrain,** depicted schematically on the left, with a corresponding magnetic resonance image on the right. Approximate regions involved in medial and lateral midbrain stroke syndromes are shown.

Signs and symptoms: *Structures involved*
1. Medial midbrain syndrome (paramedian branches of upper basilar and proximal posterior cerebral arteries)
   On side of lesion
   Eye "down and out" secondary to unopposed action of fourth and sixth cranial nerves, with dilated and unresponsive pupil: *Third nerve fibers*
   On side opposite lesion
   Paralysis of face, arm, and leg: *Corticobulbar and corticospinal tract descending in crus cerebri*
2. Lateral midbrain syndrome (syndrome of small penetrating arteries arising from posterior cerebral artery)
   On side of lesion
   Eye "down and out" secondary to unopposed action of fourth and sixth cranial nerves, with dilated and unresponsive pupil: *Third nerve fibers and/or third nerve nucleus*
   On side opposite lesion
   Hemiataxia, hyperkinesias, tremor: *Red nucleus, dentatorubrothalamic pathway*

CT Scans   CT radiographic images identify or exclude hemorrhage as the cause of stroke, and they identify extraparenchymal hemorrhages, neoplasms, abscesses, and other conditions masquerading as stroke. Brain CT scans obtained in the first several hours after an infarction generally show no abnormality, and the infarct may not be seen reliably for 24–48 h. CT may fail to show small ischemic strokes in the posterior fossa because of bone artifact; small infarcts on the cortical surface may also be missed.

Contrast-enhanced CT scans add specificity by showing contrast enhancement of subacute infarcts and allow visualization of venous structures. Coupled with multidetector scanners, CT angiography (CTA) can be performed with administration of IV iodinated contrast allowing visualization of the cervical and intracranial arteries, intracranial veins, aortic arch, and even the coronary arteries in one imaging session. Carotid disease and intracranial vascular occlusions are readily identified with this method (Fig. 446-3). After an IV bolus of contrast, deficits in brain perfusion produced by vascular occlusion can also be demonstrated **(Fig. 446-15)** and used to predict the region of infarcted brain and the brain at risk of further infarction (i.e., the ischemic penumbra, see "Pathophysiology of Ischemic Stroke" above). CT imaging is also sensitive for detecting SAH (although by itself does not rule it out), and CTA can readily identify intracranial aneurysms **(Chap. 330)**. Because of its speed and wide availability, noncontrast head CT is the imaging modality of choice in patients with acute stroke (Fig. 446-1), and CTA and CT perfusion imaging may also be useful and convenient adjuncts.

MRI
MRI reliably documents the extent and location of infarction in all areas of the brain, including the posterior fossa and cortical surface.

It also identifies intracranial hemorrhage and other abnormalities and, using special sequences, can be as sensitive as CT for detecting acute intracerebral hemorrhage. MRI scanners with magnets of higher field strength produce more reliable and precise images. Diffusion-weighted imaging is more sensitive for early brain infarction than standard MR sequences or CT **(Fig. 446-16)**, as is fluid-attenuated inversion recovery (FLAIR) imaging **(Chap. 440e)**. Using IV administration of gadolinium contrast, MR perfusion studies can be performed. Brain regions showing poor perfusion but no abnormality on diffusion provide, compared to CT, an equivalent measure of the ischemic penumbra. MR angiography is highly sensitive for stenosis of extracranial internal carotid arteries and of large intracranial vessels. With higher degrees of stenosis, MR angiography tends to overestimate the degree of stenosis when compared to conventional x-ray angiography. MRI with fat saturation is an imaging sequence used to visualize extra or intracranial arterial dissection. This sensitive technique images clotted blood within the dissected vessel wall. Iron-sensitive imaging (ISI) is helpful to detect cerebral microbleeds that may be present in cerebral amyloid angiopathy and other hemorrhagic disorders.

MRI is more expensive and time consuming than CT and less readily available. Claustrophobia and the logistics of imaging acutely critically ill patients also limit its application. Most acute stroke protocols use CT because of these limitations. However, MRI is useful outside the acute period by more clearly defining the extent of tissue injury and discriminating new from old regions of brain infarction. MRI may have particular utility in patients with TIA, because it is also more likely to identify new infarction, which is a strong predictor of subsequent stroke.