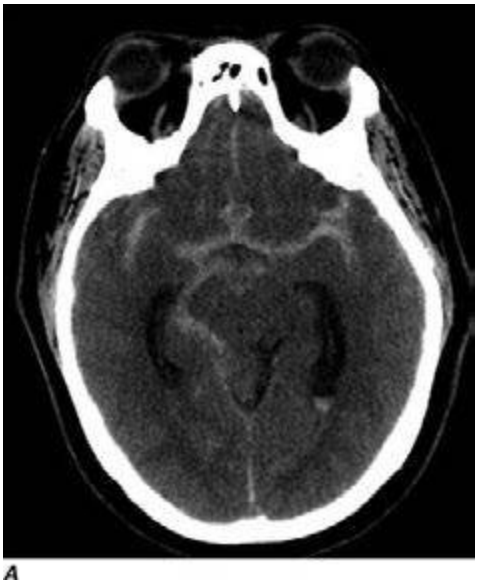

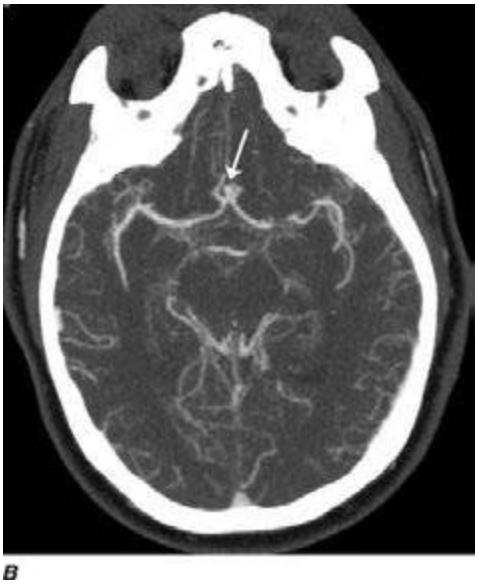

FIGURE 440e-1 Computed tomography (CT) angiography (CTA) of ruptured anterior cerebral artery aneurysm in a patient presenting with acute headache. ***A.*** Noncontrast CT demonstrates subarachnoid hemorrhage and mild obstructive hydrocephalus. ***B.*** Axial maximum-intensity projection from CTA demonstrates enlargement of the anterior cerebral artery (*arrow*). ***C.*** Three-dimensional surface reconstruction using a workstation confirms the anterior cerebral aneurysm and demonstrates its orientation and relationship to nearby vessels (*arrow*). CTA image is produced by 0.5- to 1-mm helical CT scans performed during a rapid bolus infusion of intravenous contrast medium.

INDICATIONS

CT is the primary study of choice in the evaluation of an acute change in mental status, focal neurologic findings, acute trauma to the brain and spine, suspected subarachnoid hemorrhage, and conductive hearing loss (Table 440e-1). CT is complementary to MR in the evaluation of the skull base, orbit, and osseous structures of the spine. In the spine, CT is useful in evaluating patients with osseous spinal stenosis and spondylosis, but MRI is often preferred in those with neurologic deficits. CT can also be obtained following intrathecal contrast injection to evaluate the intracranial cisterns (*CT cisternography*) for cerebrospinal fluid (CSF) fistula, as well as the spinal subarachnoid space (*CT myelography*), although intrathecal administration of gadolinium combined with MR may also be complementary.

COMPLICATIONS

CT is safe, fast, and reliable. Radiation exposure depends on the dose used but is normally between 2 and 5 mSv (millisievert) for a routine brain CT study. Care must be taken to reduce exposure when imaging children. With the advent of MDCT, CTA, and CT perfusion, the benefit must be weighed against the increased radiation doses associated with these techniques. Advanced noise reduction software now permits acceptable diagnostic CT scans at 30–40% lower radiation doses.

The most frequent complications are those associated with use of intravenous contrast agents. While two broad categories of contrast media, ionic and nonionic, are in use, ionic agents have been largely replaced by safer nonionic compounds.

Contrast nephropathy may result from hemodynamic changes, renal tubular obstruction and cell damage, or immunologic reactions to contrast agents. A rise in serum creatinine of at least 85 μmol/L (1 mg/dL) within 48 h of contrast administration is often used as a definition of contrast nephropathy, although other causes of acute renal failure must be excluded. The prognosis is usually favorable, with serum creatinine levels returning to baseline within 1–2 weeks. Risk factors for contrast nephropathy include advanced age (>80 years), preexisting renal disease (serum creatinine exceeding 2 mg/dL), solitary kidney, diabetes mellitus, dehydration, paraproteinemia, concurrent use of nephrotoxic medication or chemotherapeutic agents, and high contrast dose. Patients with diabetes and those with mild renal failure should be well hydrated prior to the administration of contrast agents, although careful consideration should be given to alternative imaging techniques such as MRI, noncontrast CT, or ultrasound (US). Nonionic, low-osmolar media produce fewer abnormalities in renal blood flow and less endothelial cell damage but should still be used carefully in patients at risk for allergic reaction. Estimated glomerular filtration rate (eGFR) is a more reliable indicator of renal function compared to creatinine alone because it takes into account age, race, and sex. In one study, 15% of outpatients with a normal serum creatinine had an estimated creatinine clearance of 50 mL/min/1.73 m^2 or less (normal is ≥90 mL/min/1.73 m^2). The exact eGFR threshold, below which withholding intravenous contrast should be considered, is controversial. The risk of contrast nephropathy increases in patients with an eGFR <60 mL/min/1.73 m^2; however, the majority of these patients will only have a temporary rise in creatinine. The risk of dialysis after receiving contrast significantly increases in patients with eGFR <30 mL/min/1.73 m^2. Thus, an eGFR threshold between 60 and 30 mL/min/1.73 m^2 is appropriate; however, the exact number is somewhat arbitrary. A creatinine of 1.6 in a 70-year-old, non-African-American male corresponds to an eGFR of approximately 45 mL/min/1.73 m^2. The American College of Radiology suggests using an eGFR of 45 mL/min/1.73 m^2 as a threshold below which iodinated contrast should not be given without serious consideration of the potential for contrast nephropathy. If contrast must be administered to a patient with an eGFR below 45 mL/min/1.73 m^2, the patient should be well hydrated, and a reduction in the dose of contrast should be considered. Use of other agents such as bicarbonate and acetylcysteine may reduce the incidence of contrast nephropathy.

Allergy Immediate reactions following intravenous contrast media can occur through several mechanisms. The most severe reactions