TABLE 104-7 MAGNETIC RESONANCE IMAGING VERSUS COMPUTED TOMOGRAPHY

MAGNETIC RESONANCE IMAGING (MRI)
Resolution 1-2 mm (higher with newer 3-Tesla magnets)
Gadolinium contrast relatively safe, except in severe renal insufficiency
Unaffected by bone; multiple planes of imaging available; functional (physiologic) imaging capacity
COMPUTED TOMOGRAPHY
Resolution >5 mm
Iodine contrast associated with anaphylaxis and rash
Faster acquisition than MRI
Metallic objects such as pacemaker or aneurysm clip preclude MRI
Acute hemorrhage well visualized
Better tolerated by patients who are severely ill or claustrophobic

They are also used to evaluate spinal cord–mediated sensory abnormalities.

Imaging Studies

Magnetic resonance imaging (MRI) and computed tomography (CT) are high-resolution imaging techniques that provide extraordinary diagnostic precision for central nervous system lesions. Most neurologic diseases, however, can have normal CT and MRI findings. Moreover, many abnormal findings on CT and MRI bear no relation to the diagnosis responsible for the patient's symptoms.

Table 104-7 compares CT with MRI. MRI is used for most purposes, although CT has the advantage of wider accessibility, greater speed of acquisition, and better tolerability by the patient. CT detects acute hemorrhage and is preferred for emergencies. MRI provides more detail and simultaneously obtains images in the horizontal, vertical, and coronal planes. Contrast media for CT or MRI are useful in the diagnosis of tumors, abscesses, and other processes that derange the blood-brain barrier. MRI can be used for functional imaging and spectroscopy; both techniques have great promise for the evaluation of cognitive and metabolic disorders, epilepsy, multiple sclerosis, and many other conditions.

MR- and CT-angiography allow noninvasive visualization of the major vessels of the head and neck. Conventional angiography with an intra-arterial injection of contrast agent is used for evaluation of many intracranial vascular abnormalities, including small aneurysms and arteriovenous malformations, and inflammation of small blood vessels.

Noninvasive ultrasonography of the carotid and vertebral arteries can define stenotic vessels. It has been supplemented by transcranial Doppler technology, which allows characterization of blood flow in intracranial arteries.

Single-photon emission CT (SPECT) is useful for the evaluation of intracranial blood flow. The development of iodine-123 ioflupane injection (DaTscan) makes it possible to visualize the dopamine transporter to follow cell loss in patients with Parkinson's disease.

Positron-emission tomography (PET) is a functional imaging technology that can demonstrate specific metabolic derangements. It is useful for evaluating local abnormalities of glucose and oxygen metabolism. PET is of particular value in defining the site of origin of focal seizures. Customized ligands may be used to identify specific pathologic processes. Examples include florbetapir F-18 (Amyvid), a U.S. Food and Drug (FDA)–approved agent for estimating β-amyloid neurotic plaque density in Alzheimer's disease, and fluorodopa F18, which is under FDA review for diagnostic use in Parkinson's disease.

TABLE 104-8 NEUROLOGIC CONDITIONS FOR WHICH GENETIC TESTS ARE AVAILABLE

- Neuromuscular diseases: nerve (Charcot-Marie-Tooth disease); muscle (myotonic dystrophy, Duchenne-Becker muscular dystrophy; anterior horn cell (spinal muscular atrophy, familial amyotrophic lateral sclerosis)
- Movement disorders: spinocerebellar ataxia, multiple types; Friedreich's ataxia; dystonia (*DYT1* mutation); Huntington's disease
- Mental retardation (fragile X syndrome)
- Mitochondrial diseases: *m*itochondrial *e*ncephalomyelopathy, *l*actic *a*cidosis, and *s*trokelike symptoms (MELAS syndrome); *m*yoclonus *e*pilepsy with *r*agged *r*ed *f*ibers (MERRF syndrome).

Genetic and Molecular Testing

There are more neurologic diseases than diseases of all other systems combined. Discoveries have revolutionized the diagnostic approach to many of these diseases, and new genetic tests are discovered every year. Table 104-8 outlines the tests that are commercially available.

Genetic testing for a disorder requires the clinician to perform a thoughtful and caring evaluation of the patient, usually with input from and evaluation of the patient's family. Important ethical issues surround the use of genetic tests, including the ability to ensure privacy, to ensure adequate psychological and social support for patients who may be given devastating news, and to address adequately the appropriateness of prenatal screening or presymptomatic testing when no treatment is available.

PROSPECTUS FOR THE FUTURE

Novel imaging techniques and molecular diagnostic studies are beginning to shed light on the pathogenesis of neurologic conditions that have been identifiable only by clinical phenomenology. Studies of previously untreatable neurodegenerative disorders are now targeting presymptomatic individuals in the hope that earlier intervention can modify disease outcomes. Despite these and foreseeable future advances, the clinical aspects of neurologic disease remain fundamentally important in understanding the impact of disease on patients and their families.

SUGGESTED READINGS

Biller J, editor: Practical neurology, ed 4, Philadelphia, 2012, Lippincott Williams & Wilkins.

Griggs RC, Jozefowicz R, Aminoff MJ: Approach to the patient with neurologic disease. In Goldman L, Schafer AI, editors: Goldman's Cecil medicine, ed 24, Philadelphia, 2012, pp 2228–2235.