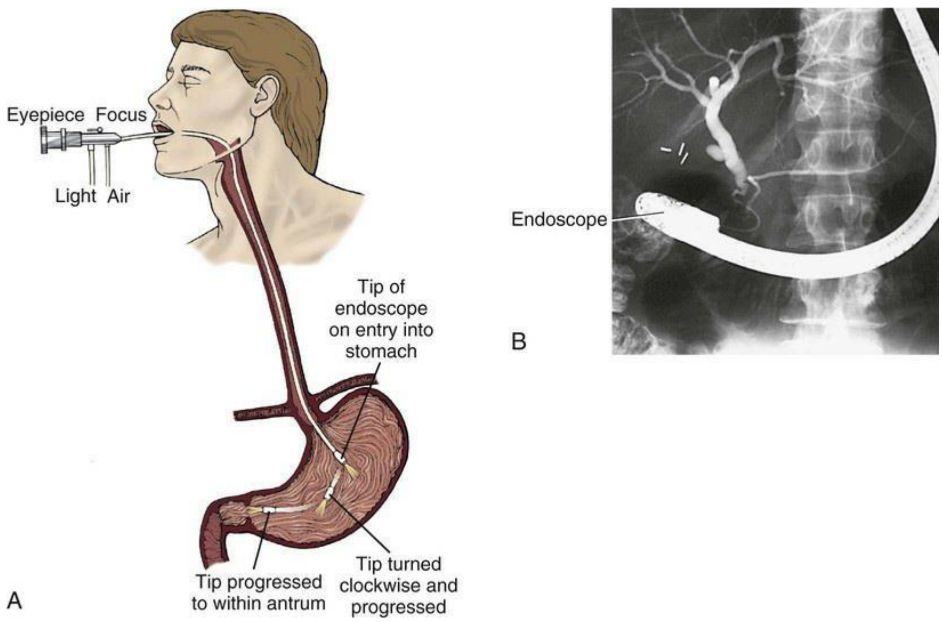
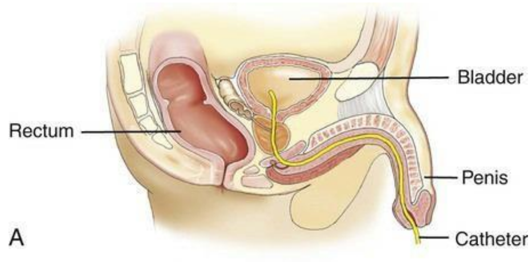
Common Diagnostic Tests and Procedures

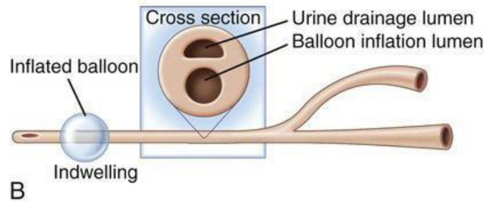
The diagnostic process helps determine a patient's health status. Laboratory analyses of blood, urine, and stool specimens, along with diagnostic radiology assist the physician in establishing a diagnosis.

An **endoscope** is an illuminated instrument for the visualization of the interior of a body cavity or organ (Figure 1). Although the endoscope is generally introduced through a natural opening (e.g., mouth, rectum), it may also be inserted through an incision, such as into the chest cavity through an incision in the chest wall. The visual inspection of the body by means of an endoscope is **endoscopy**. Endoscopic means pertaining to endoscopy or performed using an endoscope.



A catheter is a hollow flexible tube that can be inserted into a cavity of the body to withdraw or instill fluids, perform tests, or visualize a vessel or cavity. The introduction of a catheter is catheterization and to introduce a catheter is to catheterize (Figure 2 A and B). The Latin term cannula is also used to mean a hollow, flexible tube that is inserted into vessels or cavities.





Diagnostic Radiology

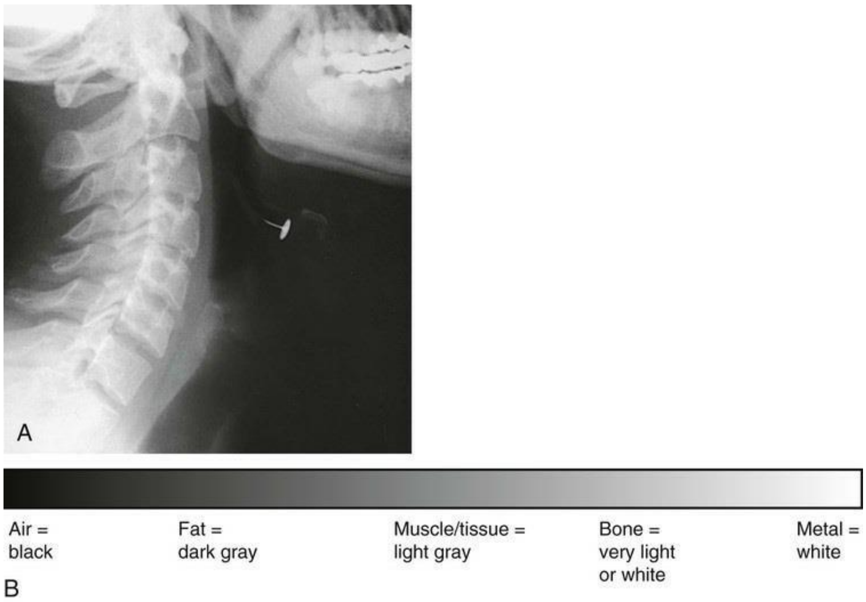
Radiology is the branch of medicine concerned with x-rays, radioactive substances, and the diagnosis and treatment of disease by using any of the various sources of radiant energy.

Several of these procedures are **non-invasive**, whereas an **invasive** procedure requires entry of a body cavity (e.g., cardiac catheterization) or interruption of normal body function (e.g., surgical incision).

Diagnostic radiology is used to establish or confirm a diagnosis. Digital radiography uses a computer to store and manipulate radiographic data. For example, in computed radiography, the image data are digitized and immediately displayed on a monitor or recorded on film.

Radiography was the predominant means of diagnostic imaging for many years, with x-rays providing film images of internal structures. An **X-ray** image is a radiograph; however, the suffix -graph refers to an instrument used for recording. The radiograph is made by projecting x-rays through organs or structures of the body onto a photographic film.

X-rays that pass through the patient expose the radiographic film or digital image receptor to create the image. X-radiation passes through different substances in the body to varying degrees. Where penetration is greater, the image is black or darker; where the x-rays are absorbed by the subject, the image is white or light grey. Thus, air appears black, fat appears dark grey, muscle tissue appears light grey, and bone appears very light or white. Very dense substances, such as lead or steel, appear white because they absorb the rays and prevent them from reaching the image receptor (Figure 3).



Substances that do not permit the passage of x-rays are described as radiopaque. Radiolucent describes substances that readily permit the passage of x-rays.

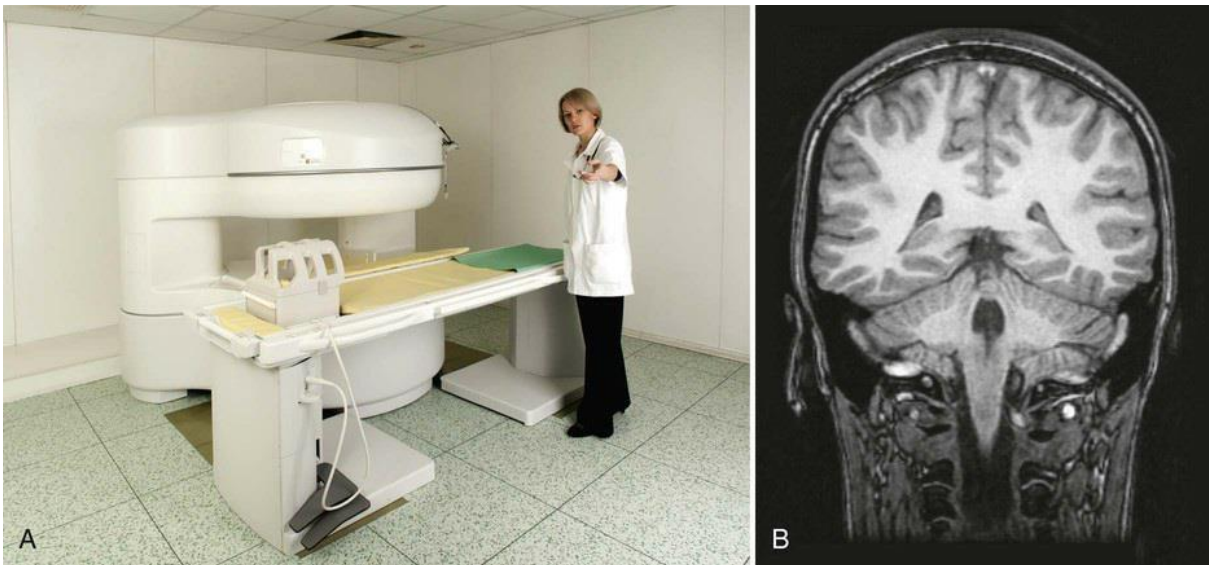
Additional diagnostic imaging modalities include the following:

- Computed tomography (CT)
- Magnetic resonance imaging (MRI)
- Sonography, also called echography, ultrasonography, and ultrasound
- Contrast imaging

- Nuclear imaging (placing radioactive materials into body organs for the purpose of imaging).

Computed tomography uses ionizing radiation to produce a detailed image of a cross section of tissue, similar to what one would see if the body or body part were actually cut into sections. The procedure, however, is painless and noninvasive (Figure 4).

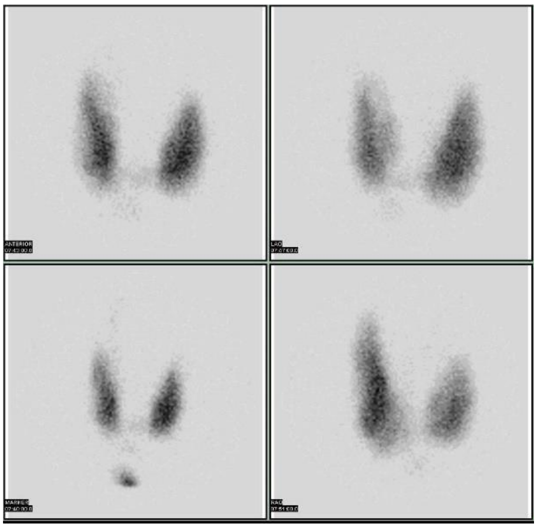
Magnetic resonance imaging creates images of internal structures based on the magnetic properties of chemical elements within the body and uses a powerful magnetic field and radio wave pulses rather than ionizing radiation such as xrays. MRI produces superior soft tissue resolution for distinguishing adjacent structures (Figure 5). Patients must remain motionless for a time and may experience anxiety because of being somewhat enclosed inside the scanner.



Ultrasonography, **ultrasound imaging**, and other names, **sonography** is the process of imaging deep structures of the body by sending and receiving highfrequency sound waves that are reflected back as echoes from tissue interfaces. Conventional sonography provides two-dimensional images, but the more recent scanners are capable of showing a three-dimensional perspective. The record produced is called a **sonogram** or an **echogram**. Sonography is very safe and does not use ionizing radiation. It has many medical applications, including imaging of the fetus (Figure 6).

Contrast imaging is the use of radiopaque materials to make internal organs visible on x-ray images. A contrast medium may be swallowed, introduced into a body cavity, or injected into a vessel, resulting in greater visibility of internal organs or cavities outlined by the contrast material (Figure 7).

Nuclear scans involve administering radiopharmaceuticals to a patient orally, into the vein, or by having the patient breathe the material in vapor form. Pharmaceuticals are medicinal drugs, and radiopharmaceuticals are those that are radioactive. Computerized scanners called gamma cameras detect the radioactivity emitted by the patient and map its location to form an image of the organ or system (Figure 8).



Positron emission tomography (PET) combines computed tomography and radioactive substances to produce enhanced images of selected body structures, especially the heart, blood vessels, and the brain (Figure 9). The radioactive materials used in PET are very short-lived, so the patient is exposed to extremely small amounts of radiation.