Computed Tomography

CT has many applications in pulmonary medicine and provides more detailed information about lung structure than chest radiography. With the use of this technique, cross sections of the entire thorax can be obtained, usually at 1-cm intervals. CT scanning allows visualization of airways up to the seventh generation and delineation of parenchymal anatomy, texture, and density. Image contrast can be adjusted to optimize visualization of the lung parenchyma or pleural and mediastinal structures. The use of intravenous contrast material as part of the examination permits separation of vascular from nonvascular mediastinal structures. CT scans provide tremendous anatomic resolution when compared with chest radiography, but they expose the subject to about 70 times the radiation of a routine chest radiograph.

CT of the chest helps to characterize pulmonary nodules and masses, distinguish between pleural thickening and pleural fluid, estimate the size of the heart and the presence of pericardial fluid, identify patterns of involvement of interstitial lung disease, detect cavities, identify intracavitary processes such as mycetoma, quantify the extent and distribution of emphysema, detect and measure mediastinal adenopathy for staging of lung cancer, and identify vascular invasion by neoplasm (Fig. 15-25). Newer generations of CT scanners are able to use multiple x-ray beams to create between 4 and 64 images simultaneously at a much faster rate (<10 seconds) than with the older models, which used only a single x-ray beam and detector. Recently, low-dose CT has been recognized as means of screening for lung cancer in high-risk patients.

CT angiography allows for construction of three-dimensional images of the pulmonary vascular system. This imaging technique has emerged as the procedure of choice for identifying pulmonary embolism, supplanting pulmonary ventilation-perfusion scintigraphic lung scanning. The technique also can be used to identify pulmonary vascular abnormalities such as aortic dissection, pulmonary venous malformations, and aortic aneurism.

High-resolution CT is a technique that generates thin (1-mm) anatomic slices to provide a high-contrast image of the pulmonary parenchyma. With high-resolution CT, a special reconstruction algorithm sharpens the soft tissue interfaces to provide superior visualization of the pulmonary parenchyma. This technique is used primarily to identify interstitial lung disease and bronchiectasis. It is extremely useful for identifying interstitial lung disease that may not be apparent on a plain chest radiograph, and it has supplanted bronchography in the diagnosis of bronchiectasis.

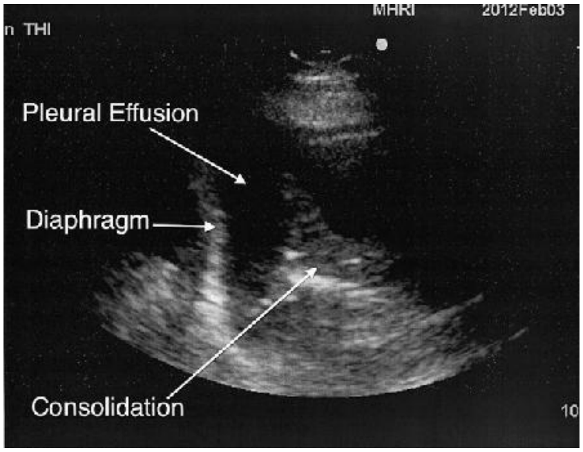

FIGURE 15-24 Ultrasound image of the lung depicts the diaphragm, a pleural effusion, and an infiltrate.

Magnetic Resonance Imaging

MRI is a tomographic technique that uses radio waves modified by a strong magnetic field to produce an image resulting from the resonation of protons in tissue water. The chief advantage of MRI is that it does not entail the use of ionizing radiation. Because of the low proton density in air-filled lungs, artifacts arising from multiple air-tissue interfaces and respiratory motion artifacts limit the ability of MRI to image pulmonary parenchyma. However, vascular structures and pulmonary perfusion are well imaged by MRI, especially with the use of intravenous contrast agents such gadolinium chelates. Therefore, MRI is very useful in the study of aortic dissection and may have a role in the evaluation of pulmonary emboli. Three-directional velocity-encoded MRI allows three-dimensional, time-resolved cine

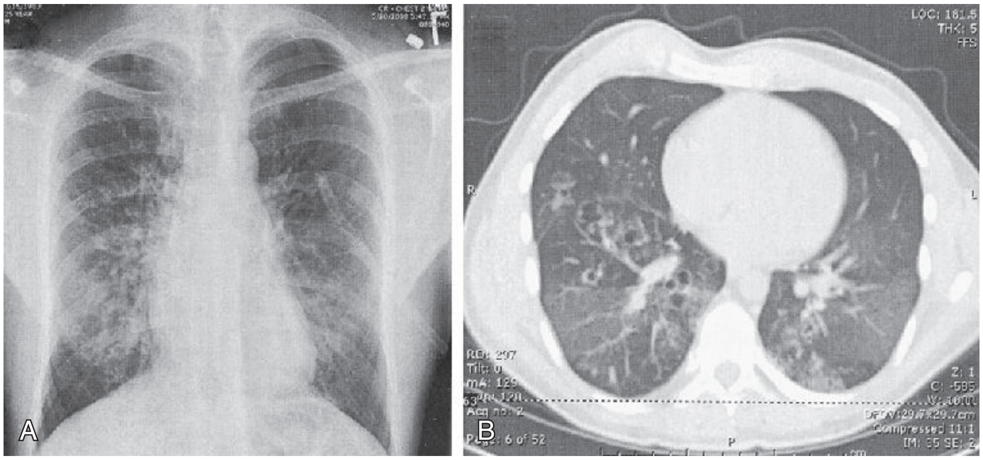

FIGURE 15-25 Chest radiograph (**A**) and chest computed tomographic (CT) scan (**B**) of a patient with severe bronchiectasis. The abnormally dilated airways are better appreciated on the CT scan.