INTRODUCTION

Imaging plays a critical role in the diagnosis of heart disease. In the past 25 to 30 yr, advanced imaging modalities such as digital angiography, echocardiography, magnetic resonance imaging (MRI), computed tomography (CT), and nuclear cardiology have become important in the evaluation of the heart. However, the conventional radiographic examination remains the mainstay of cardiac imaging. This chapter will discuss the role of the chest radiograph in the diagnosis of cardiac disease in adults, with an emphasis on both normal cardiovascular anatomy and pathoanatomy in a variety of diseases. Correlation will be made with cross-sectional imaging in order to illustrate important anatomic points.

NORMAL ANATOMY

The standard radiographic examination of the chest consists of upright frontal (posteroanterior) and lateral projections (Fig. 1). If a patient is acutely ill or is unable to stand upright, an anteroposterior frontal radiograph may be obtained with the patient in the supine position, and the lateral radiograph is usually omitted. It is important to ensure that the patient is properly positioned in both the frontal and lateral views so that cardiac structures can be evaluated accurately. In thepast left and right anterior oblique projections were obtained routinely, often with contrast medium in the esophagus. With the advent of echocardiography, however, the current role of oblique radiographs is limited.

In the normal chest radiograph, there is excellent inherent contrast between the air-filled lungs, pulmonary vessels, and mediastinum. The chest film therefore is the primary imaging study for evaluation of the lung parenchyma and vessels. However, the components of the mediastinum, including the heart, the blood, and the fat, have similar radiographic densities and cannot be easily distinguished on chest radiographs. Nevertheless, the margins of the heart and mediastinal vessels are clearly demarcated, and variation from the normal appearance suggests the presence of disease.

Left Subclavian Artery

On the frontal chest radiograph, the left subclavian artery forms the superior portion of the left mediastinal border above the aortic arch (Fig. 1A). This artery usually forms a concave border with the lung, although a convex border may be seen if there is increased blood flow, such as in coarctation of the aorta, or if the vessel is tortuous because of atherosclerosis or hypertension. A persistent left superior vena cava is suggested by a straight or convex left supraaortic border.

Aorta

On the frontal view, the ascending aorta forms a convex margin above the right heart border (Fig. 1A). When the ascending aorta enlarges, it projects farther to the right. On the lateral view,
the anterior margin of the ascending aorta lies above the right ventricle but is not seen in the normal individual due to an abundance of mediastinal fat.

The aortic arch or “knob” forms a convex border just below the left subclavian artery on the frontal radiograph (Fig. 1A). The aortic arch displaces the trachea slightly to the right. In a patient with a right aortic arch, the trachea is deviated slightly to the left (1). The arch is usually small in the young, healthy individual. An enlarged aortic arch is higher and wider than the normal aorta.

The ascending aorta or arch may be enlarged on the frontal view in individuals with aortic aneurysm, aortic regurgitation, systemic hypertension, or atherosclerosis.

Immediately below the aortic arch along the left mediastinal border, there is an indentation known as the aorticopulmonary window, bordered by the lower margin of the aortic arch and by the superior margin of the left pulmonary artery (Fig. 1A). Convex bulging of the aorticopulmonary window may reflect a ductus diverticulum, lymphadenopathy, or other mass (2).

**Pulmonary Vasculature**

The main pulmonary artery forms a slightly convex border along the left side of the mediastinum between the aortic knob and the left atrial appendage (Fig. 1A). A prominent convex bulge in this location indicates enlargement of the main pulmonary artery. A large main pulmonary artery may be related to pulmonary arterial hypertension; increased blood flow, as in anemia or a left-to-right shunt; or turbulent flow, as in patients with pulmonary valvular stenosis. On the other hand, the main pulmonary artery border may be flat or convex in patients with transposition of the great vessels, truncus arteriosus, tetralogy of Fallot, or pulmonary atresia. On the lateral projection the anterior border of the main pulmonary artery, located above the right ventricle, is not clearly seen due to the presence of mediastinal fat.

The left pulmonary artery is visualized as a smooth arc just inferior to the aorticopulmonary window. The left pulmonary artery arches over the left mainstem bronchus, as seen on the lateral projection (Fig. 1B). On the other hand, the right pulmonary artery is a round or oval opacity anterior to the right mainstem bronchus on the lateral view (Fig. 1B).

The intrapulmonary branch arteries parallel the airways, and gradually decrease in size toward the lung periphery. The arteries and bronchi are of approximately the same size at any given level; comparison of arterial and bronchial diameters is therefore useful when assessing increase or redis-