

result from marked reductions in glomerular filtration rate and is exacerbated by use of RAAS inhibitors and potassium-sparing diuretics (**Chap. 258**). Hypo- or hyperkalemia may lead to atrial or ventricular arrhythmias. Hypophosphatemia and hypomagnesemia are commonly associated with chronic alcohol use.

Anemia is not diagnostic of HF, but when present, it may exacerbate underlying ischemic heart disease and should be corrected. Rarely, severe anemia may cause high-output HF typically in the presence of underlying cardiovascular disease. The presence of iron deficiency (with or without anemia) is increasingly recognized in patients with chronic HF and has been attributed to decreased gut absorption, impaired hepatic storage, and chronic blood loss. Repletion with IV iron results in improved symptoms and exercise capacity and reduced HF hospitalizations, but its effect on survival remains uncertain.

Chest X-Ray Major abnormalities on chest imaging associated with left HF include enlarged cardiac silhouette (cardiothoracic ratio >0.5) and pulmonary venous congestion. Early radiologic signs of acute HF include upper zone venous redistribution and thickening of interlobular septa. When the pulmonary capillary wedge pressure is moderate to severely elevated, alveolar edema can present as diffuse haziness extending downward toward the lower lung fields. The absence of these findings in patients with chronic HF reflects the increased capacity of the lymphatics to remove interstitial and/or pulmonary fluid. Pleural effusions of varying size and distribution are common in biventricular HF. Chest x-ray can also be used to identify noncardiac causes of dyspnea (e.g., pneumonia, COPD).

Electrocardiogram No specific electrocardiographic (ECG) pattern is diagnostic of HF. Rather, the ECG may provide important information regarding presence of underlying cardiac disease. For example, left ventricular hypertrophy and left atrial enlargement suggest HFpEF due to hypertension, aortic stenosis, or hypertrophic cardiomyopathy. The presence of Q waves or infarction is suggestive of ischemic heart disease, whereas Q waves with reduced QRS voltage (pseudo-infarct pattern) may be seen with restrictive or