



Figure 12-19 Schematic for the causes and outcomes of ischemic heart disease (IHD), showing the interrelationships among coronary artery disease, acute plaque change, myocardial ischemia, myocardial infarction, chronic IHD, congestive heart failure, and sudden cardiac death.

Chronic Ischemic Heart Disease

The designation chronic IHD (often called *ischemic cardiomyopathy* by clinicians) is used here to describe progressive congestive heart failure as a consequence of accumulated ischemic myocardial damage and/or inadequate compensatory responses. In most instances there has been prior MI and sometimes previous coronary arterial interventions and/or bypass surgery. Chronic IHD usually appears postinfarction due to the functional decompensation of hypertrophied noninfarcted myocardium (see earlier discussion of cardiac hypertrophy). However, in other cases severe obstructive coronary artery disease may present as chronic congestive heart failure in the absence of prior infarction. Patients with chronic IHD account for almost 50% of cardiac transplant recipients.

MORPHOLOGY

Hearts from patients with chronic IHD have cardiomegaly, with left ventricular hypertrophy and dilation. Invariably there is some degree of stenotic coronary atherosclerosis. Discrete scars representing healed infarcts are usually present. The mural endocardium often has patchy fibrous thickenings (due to abnormal wall shear forces), and mural thrombi may be present. Microscopic findings include myocardial hypertrophy, diffuse subendocardial vacuolization, and fibrosis.

KEY CONCEPTS

Ischemic Heart Disease

- The vast majority of ischemic heart disease is due to coronary artery atherosclerosis; vasospasm, vasculitis, or embolism are less common causes.
- Cardiac ischemia results from a mismatch in coronary supply and myocardial demand, and presents as different, albeit overlapping syndromes:
 - *Angina pectoris* is chest pain due to inadequate perfusion, and is typically due to atherosclerotic disease with greater than 70% fixed stenosis (so-called critical stenosis).
 - *Unstable angina* results from a small fissure or rupture of atherosclerotic plaque triggering platelet aggregation, vasoconstriction, and formation of a mural thrombus that need not necessarily be occlusive.
 - *Acute myocardial infarction* typically results from acute thromboses after plaque disruption; most occur in plaques that did not previously exhibit critical stenosis.
 - *Sudden cardiac death* usually results from a fatal arrhythmia, typically without significant acute myocardial damage.
 - *Chronic ischemic heart disease* is progressive heart failure due to ischemic injury, either from prior infarctions or chronic low-grade ischemia.
- Myocardial ischemia leads to loss of function within 1 to 2 minutes, but causes necrosis only after 20 to 40 minutes. Myocardial infarction is diagnosed based on symptoms, electrocardiographic changes, and measurement of serum CK-MB and troponins. Gross and histologic changes of infarction require hours to days to develop.
- Infarction can be modified by therapeutic intervention (e.g., thrombolysis or stenting), which salvages myocardium at risk, but potentially induces reperfusion-related injury.
- Complications of infarction include: ventricular rupture, papillary muscle rupture, aneurysm formation, mural thrombus, arrhythmia, pericarditis, and CHF.

Arrhythmias

Abnormalities in myocardial conduction can be sustained or sporadic (*paroxysmal*). Aberrant rhythms can be initiated anywhere in the conduction system, from SA node down to the level of an individual myocyte; they are typically designated as originating from the atrium (*supraventricular*) or within the ventricular myocardium. Arrhythmias can manifest as *tachycardia* (fast heart rate), *bradycardia* (slow heart rate), an irregular rhythm with normal ventricular contraction, chaotic depolarization without functional ventricular contraction (*ventricular fibrillation*), or no electrical activity at all (*asystole*). Patients may be unaware of a rhythm disorder, or may note a “racing heart” or *palpitations* (irregular rhythm); loss of adequate cardiac output due to sustained arrhythmia can produce light-headedness (near syncope), loss of consciousness (*syncope*), or *sudden cardiac death* (see later)

Ischemic injury is the most common cause of rhythm disorders, either through direct damage, or through the dilation of heart chambers that alters conduction system firing.